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COURSES IN SECONDARY AGRICULTURE FOR SOUTHERN SCHOOLS.[1]

(FIRST AND SECOND YEARS)

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INTRODUCTION.

The following outlines are the result of a demand for a more uniform standard in agricultural instruction in secondary schools of the South. They are to cover work in agriculture for the first two years of a 4-year course. It is assumed that the students have had work in nature study and a general course in elementary agriculture in the graded or rural school.

ADAPTATION TO LOCAL CONDITIONS.

It is not expected that all the lessons will be given in their present order of sequence. It is left with the local teacher or supervisor to work out a seasonal sequence or such order of presentation as will fit local needs. Neither is it expected that topics will be given equal importance in all districts. In adapting these courses to meet local needs it may be necessary to expand one subject or topic at the expense

[1] Prepared under the direction of C. H. Lane, Chief, Specialist in Agricultural Education.

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of another. For example, lessons are outlined covering wheat, rice, and cane. It is not expected that these topics will be of equal importance in any one district. Where rice or cane is important it may not be necessary to treat wheat as a lesson, in which case more time may be given the other crops.

Adaptation to students.—The lessons should be adapted to the needs and capacities of the students. Particular care should be taken with those lessons dealing with the science underlying agricultural practice that the subject be kept within the range of secondary students. For example, students may get a comprehension of how plants grow and the principles which underlie plant breeding without going into technical plant physiology and genetics. Likewise, as an aid to a better understanding of the practice of feeding, students should know the simpler aspects of digestion and assimilation and understand the basis for scientific feeding, yet preliminary lessons on these subjects need not involve anything beyond very elementary chemistry and physiology. The extent to which these lessons are considered will depend upon the maturity of the students and their training in elementary science.

USE OF TEXTS AND REFERENCES.

It is hoped that the outlines with the references given will keep the instructor from following a textbook too closely. A list of books for use as general references is given at the end of each course. While the students may be required to buy one or more books during the course, these texts should in all cases be supplemented and adapted to both the student and the community by making special assignments to other references. Special references to bulletins of this department [1] are given with nearly every lesson. It is expected that publications of the State agricultural college, experiment station, or board of agriculture will be used also, especially the bulletins of the State in which the school is located. It is assumed that the school will maintain files of such publications of their own State as pertain to agriculture, the Yearbooks of the United States Department of Agriculture, and all Farmers' Bulletins pertaining to the agriculture of the district in which the school is located. Reference material should be secured early so that it will be available as the lessons are taken up.

[1] Farmers' Bulletins and Yearbooks of the United States Department of Agriculture may be obtained free as long as the supply lasts, on application to the Secretary of Agriculture, Washington, D. C., or to any Senator or Representative in Congress. Other publications of the Department of Agriculture and those named when no longer available for free distribution may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a nominal price. Price lists covering various Government publications may be obtained free from the Superintendent of Documents. Each teacher should secure a copy of Price List No. 16, which includes Farmers' Bulletins, Yearbooks, and department bulletins of the United States Department of Agriculture.

Lists of these publications prepared for teachers may be obtained from the agricultural instruction division of the States Relations Service.

USE OF ILLUSTRATIVE MATERIAL.

In connection with most of the lessons suggestions are made for illustrative material to use in the classroom. The instructor should go over the course early in the year, as much of this material must be gathered in season or secured from a distance.

DISTRIBUTION OF TIME AND CREDIT.

In the preparation of the outline it has been assumed that there will be in the school year 36 weeks of five days each. Periods of 45 to 60 minutes, three days each week, are to be spent in the classroom, and time equal to two hours a day, two days in the week, in field trips, practicums, and home-project work. One hundred and four lessons are given, leaving four classroom periods for examinations or reviews. In the course in soils and crops the remainder of the time is divided equally between the laboratory and home projects. In the course in animal husbandry relatively more time is left for home work. As many practicums may be worked out at home to greater advantage than at school, credit should be given for such work when evidence is given that it is properly done. Work involving skill in farm operations is suited especially well to home practicums. Credit for home work should be allowed on the same basis as that given for practical work at school—that is, two hours' work for one hour credit.

THE HOME PROJECT.[1]

In the course in soils and crops time equal to 36 double periods, or 72 hours, is left for the student's individual project. This approximates the time needed to produce an acre of corn, hence, growing an acre of corn may be required of the student before he is given credit for the course. It is even more necessary to adapt practicums and projects to the needs of the student and the community than it is to adapt the work of the classroom. All students in the course may not be able to grow an acre of corn, but it may be possible for them to grow some other crop. Projects should be provided for students who do not live on farms, as they are in special need of practical instruction. Where the school owns a farm it may be possible for all such students to work out their projects at the school, or if they can secure work upon a farm which may be connected in a definite way with their course, credit should be given for such work as a substitute for a home project.

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[1] See U. S. Department of Agriculture Bulletin 346, Home Projects in Secondary Courses in Agriculture.

OUTLINE FOR SOILS AND CROPS—FIRST YEAR.

(One unit.)

HOW PLANTS GROW.

(Nine lessons, three double periods for practical work.)

Reference: Any modern high-school text in botany.

LESSON 1.—*Development of a Plant from the Seed.*

1. What the seed represents.
2. Conditions essential to development.
3. Vitality of seeds.
4. Parts of seed and plantlet.
5. Testing seeds.

Illustrative material: Germinating seeds of different types.

EXERCISE 1.—*Germination Test of Seeds.*

Purpose: Testing for viability and to determine conditions essential to germination.

Directions: Secure a quantity of wheat or any small hardy seed known to be fresh, and another lot of the same kind of seed known to be at least 10 years old. Have each student count out 50 to 100 seeds of each sample and place them in a plate between moistened Canton flannel or blotting paper. With a slip of paper to designate the sample, this seed should be covered with another plate or a piece of glass to prevent too rapid evaporation of moisture. (Paper pie plates, one within another, if kept moist, serve well without blotters or cloths.) These plates of seeds should be kept in a warm room and enough water added to keep the seeds moist but not wet. The class as a whole should take three samples of the fresh seed, one to be kept moist, but placed where it is cold; the other two to be kept in a warm place, but one lot kept covered with water to exclude air, and the other allowed to become dry. At the end of six days the tests should show results in a vigorous germination of the fresh seed kept warm and moist and a lesser degree of vigor in the old seed and those samples deprived of warmth, moisture, and air.

Record and *report:* Each student should make a record of how the tests were made and write a report bringing out answers to the following questions: What per cent of the old and the fresh seed germinated? Why did the old seed lack vigor in germination? Why did the seed covered with water fail to germinate well? What effect did the low temperature have upon the seeds? What was the effect of the lack of moisture? What conditions are essential to the germination of seeds? Under what conditions should farm and garden seeds be tested for viability? (Tables showing optimum, minimum, and maximum temperatures at which common seeds germinate and the number of years various kinds of seeds remain viable will prove helpful in connection with a study of germination.)

Special reference: Testing Farm Seeds in the Home and in the Rural School, Farmers' Bulletin 428.

LESSON 2.—*The Work of Roots.*

1. Development of roots.
2. The plant cell.
3. Root hairs.
4. Kinds of roots.
5. Function of roots.
6. Root systems.

Illustrative material: Plants showing root hairs; charts showing structure of roots.

EXERCISE 2.—*A Study of Root Hairs and Osmosis.*

Purpose: To show how plants take in mineral food.

Directions: If the germinated wheat seed is allowed to become slightly dry between the paper pie plates or the folds of the blotting paper the root hairs will develop to an abnormal length so that they may be seen readily with the naked eye.

The method by which mineral food in solution is taken into the plant through the root hairs may be shown in the following manner: Fill a thistle tube partly full of molasses and tie over the large end of the tube a piece of moistened bladder. Insert the tube in the cork of a wide-mouthed bottle and immerse it in water colored with ink. In a few hours the water should pass through the bladder and force the molasses out of the top of the tube.

Record and *report:* Drawings should be made of a plantlet, showing the root hairs, and of the apparatus illustrating osmosis. Each student should also make a written report of the demonstration in which the following questions are answered: Why do root hairs develop to a greater extent if the roots of the plantlet become slightly dry? What is the nature of the root hairs? Upon what part of the root are they found? How is the principle of osmosis applied to the taking in of plant food by the root hairs?

LESSON 3.—*The Work of Stems.*

1. Development of the stem.
2. Structure of stems.
3. How stems grow.
4. Buds.
5. Movement of sap.
6. Kinds of stems.

Illustrative material: Different kinds of stems; charts showing cellular structure of stems.

LESSON 4.—*Leaves.*

1. Forms of leaves.
2. Arrangement.
3. Structure.
4. Photosynthesis.

Illustrative material: Leaves of different forms; charts showing structure and photosynthesis.

LESSON 5.—*Flowers.*

1. Function of flowers.
2. Parts of flowers.
3. Forms of flowers.

Illustrative material: Flowers of different forms; charts showing structure.

LESSON 6.—*Fertilization of the Ovule.*

1. Conditions essential to fertilization.
2. How the pollen reaches the ovule.
3. Devices for securing cross-pollination.

Illustrative material: Charts showing fertilization of the ovule.

LESSON 7.—*Some Principles of Plant Breeding.*

1. Law of heredity.
2. Law of variation.
3. Selection.
   (*a*) Natural.
   (*b*) Selection by man.
4. Inducing variation.
5. Technique of cross-pollination.
6. Propagation.
   (*a*) Sexual.
   (*b*) Asexual.

Illustrative material: Chart showing Mendel's law.

EXERCISE 3.—*A Study of Plant Growth.*

Purpose: To show how plants develop from the seed.

Directions: Have each student fill a flat box to a depth of 5 inches with sand. On one side seeds of corn, squash, peas, and beans should be planted at a depth of 1 inch, and on the other side the same kind of seeds 4 inches deep. The planting should be done two weeks before the study is to be made, and the box placed where it may be kept warm and moist. The seeds should be studied by the students as they germinate and as the plants develop.

Record and *report:* Drawings of an entire plant of each kind should be made and the parts named. In a written report which should accompany the drawings the following questions should be answered: In what respects are the pea, bean, and squash alike? How do they differ from the corn and wheat in germination? In relation to its cotyledons, how does the pea differ from the bean in germination? How do the cotyledons of the bean differ from those of the squash in the development of the plant? How does the squash get rid of its seed case? What service do the cotyledons render the developing plant? What happens if one or both of the cotyledons are broken off? Why may corn and peas be planted deeper than beans and squashes? How do the roots of the plants differ?

LESSON 8.—*Elements of Plant Food.*

1. Sources of plants.
2. Definition of element and compound.
3. Food from the air.
4. Food from the soil and water.

LESSON 9.—*Composition of Plants.*

1. Organic *v.* inorganic matter.
2. Crude fiber.
3. Carbohydrates.
4. Proteids.
5. Fats.

Illustrative material. Chart showing composition of plants.

SOILS.

(36 lessons, 18 periods for practical work.)

References: Any of the general texts in soils. Also, United States Department of Agriculture Bulletin 355, Extension Course in Soils. Price List No. 46, United States Public Documents Relating to Soils (for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C.).

LESSON 1.—*Weather and Water in Soil Making.*

1. Weathering of rocks.
2. Work of water.
3. Ice as a factor.

LESSON 2.—*Work of Plants and Animals.*

1. Lichens and mosses.
2. Stems and roots.
3. Work of animals.
4. Sources of organic matter in the soil.
5. Life in the soil.

Illustrative material: Stones upon which lichens, mosses, or other plants are growing.

LESSON 3.—*Transportation of Soils.*

1. Residual soils.
2. Gravity as a factor—colluvial soils.
3. Water as a factor—alluvial soils.
4. Ice as a factor—glacial soils.
5. Wind as a factor—loessial soils.

EXERCISE 4.—*A Field Study of Soils.*

Purpose: To determine the nature of soil and to study the various processes of formation and transportation.

Directions: In connection with a study of soil formation the entire class should be taken to a near-by railroad cut, a gully washed by water, or some excavation where the students may study the relation of the soil to the subsoil and the underlying rock and note the effects of the various agencies in the formation and modification of soils.

Record and *report:* A written report, which should be required of each student, should bring out, with any notes of special interest, answers to the following questions: Are the soils of the neighborhood visited residual or transported? What relation, if any, do you note between the nature of the prevailing types of soils and the rocks which prevail in the district? What is the difference between the soil and subsoil? What particular effects, if any, did you note of the action of water in the making of soils? What are the effects of water in the transportation of soils? What effects of lichens, mosses,

and other plants were noted? Did you note any particular effects of the work of animals? To what agents do you attribute whatever crumbling of surface rocks you have seen? Why should the farmer understand the forces and agents which are making and moving soils? Can the farmer do anything to aid the formation of soils? Can he do anything to hold the soil where it is needed?

LESSON 4.—*Physical Nature of Soils.*

1. Fineness of soils.
2. Texture of soils.
3. Weight of soils.
4. Color of soils.

LESSON 5.—*Water-holding Capacity of Soils.*

1. The soil as a reservoir for water.
2. Forms of soil moisture.
3. Relation of capacity to nature of soil.
4. Relation to depth of soil.

EXERCISE 5.—*A Study of the Water-holding Capacity of Soils.*

Purpose: To test the capacity of soils of different types to take in rainfall or irrigation water.

Directions: Tie cheesecloth over the small ends of five student-lamp chimneys, which should then be mounted in a rack with the covered ends each placed in a glass tumbler. (If the lamp chimneys can not be procured, long-necked bottles, such as vinegar bottles, may be used after the bottoms have been removed in the following manner: File a groove parallel with the bottom. Lay a poker heated red hot upon the groove. As soon as a small crack is started draw the poker around the bottle and the crack will follow.) Fill the chimneys or bottles to the same height with the following kinds of soil: (1) Gravel, (2) sand, (3) loam, (4) clay, and (5) peat or leaf mold. The soil should be made firm by jarring the rack three or four times. Pour water into each of the chimneys just rapidly enough to keep the surface of the soil covered and note the exact time before it begins to drop into the tumbler below.

To show the effects of packing take two chimneys with an equal quantity of the same kind of soil, packing it firm in one chimney and leaving it loose in the other. Repeat the water-pouring process, noting the time as before.

To show which soil drains the more readily empty and replace each tumbler as soon as all free water has disappeared from the upper surface of the soil above it. After the water has ceased dripping from all the chimneys measure and compare the water in each tumbler, making a record of the order in which they cease dripping.

To determine which soil will store up the greatest quantity of moisture weigh each chimney before and after filling it with dry soil, and again after the water has ceased dripping from it. The

difference between the net weight of the dry soil and that of the wet soil is the weight of the water stored. During the time that the chimneys are dripping, which may be several days, they should be covered to prevent evaporation of water from the surface of the soils.

Record and *report:* A record should be made by each student of the time and weights involved in each part of the exercise. A written report should bring out the application of this test to the capacity of different types of soils to take in and retain rainfall and irrigation waters. The effects of plowing to loosen the soil and rolling to pack it should also be brought out in their relation to the water-holding capacity of soils.

LESSON 6.—*Temperature and Ventilation of Soils.*

1. Relation to plant growth.
2. Relation to soil moisture.
3. Relation to color.

EXERCISE 6.—Factors influencing temperature of soils.

Purpose: To impress upon the minds of the students the effects of color, drainage, and slope of land upon the temperature of the soil.

Directions: Fill two boxes 12 inches square and 8 inches deep with loam soil or the type of soil which prevails near the school, making the surface smooth. Cover the surface of one with lampblack and the other with powdered chalk or lime dust. Place both boxes in the same horizontal positions in the sun. Insert thermometers about one-half inch below the surface of each and take readings every hour during the day until two or three hours after sunset.

Fill two large flowerpots with the same kind of soil after the drainage hole of one has been stopped up with paraffin. Saturate each with equal amounts of water. Insert the bulb of a thermometer an inch below the surface in each. Set in direct sunlight and take readings twice each day for two or three days.

Fill three boxes 12 inches square and 8 inches deep with loam soil and set in line in the sunlight. Leave one level, tilt one 30° to the north and the other 30° to the south. Using thermometers as before, take readings every hour during a sunny day.

Instead of using thermometers, seeds which are known to be viable may be planted in the boxes and pots and the effects of the temperatures noted upon the growth of the plants. It will be profitable also to have each student take temperatures in the field of soils of different colors, with different degrees of drainage and with different slopes, in each case securing the same type of soil and securing all conditions except the one tested as nearly equal as possible.

Record and *report:* Each student should make a record in tabulated form showing the temperature readings for the soils under the

different conditions so that results may be compared and conclusions drawn. A written report should bring out answers to the following questions: What conclusions may be drawn as to the influence of color upon the temperature of soils? Are the differences recorded in sunlight as marked as when the sun is not shining? Why does dark soil warm up more quickly than light soil? What is your conclusion as to the temperature of drained and undrained soils? Is it possible to lengthen the growing season by draining wet soils? Give reasons for the difference in temperature of the boxes tilted in different directions. What factors would you consider in selecting land that will produce early crops? What does this exercise show with regard to the value of humus in the soil?

LESSON 7.—*Chemical Nature of Soils.*

1. The soil as a source of plant food.
2. Relation to rock-forming minerals.
3. Relation to water movements.

Illustrative material: Samples of common rocks and minerals.

LESSON 8.—*Organic Matter in the Soil.*

1. Relation to physical nature of soils—texture, weight, color, temperature, ventilation, and water-holding capacity.
2. Relation to chemical nature of soils—a source of plant food.
3. Humus.

Illustrative material: Samples of muck, peat, and leaf mold.

EXERCISE 7.—*Effects of Organic Matter upon Soils.*

Purpose: To show how organic matter increases the water-holding capacity of soils and enhances their production.

Directions: Repeat Exercise 5 with samples 2, sand, and 4, clay, after mixing with each one-third of its volume of leaf mold or well-rotted manure. Compare the weight of each sample before and after mixing. Compare the water-holding capacity of the mixtures with that of the original samples.

Fill flower pots, 4 inches or larger (tin cans will serve the purpose if holes are punched in the bottoms for drainage), with soil as follows: (1) Sand; (2) two-thirds sand; one-third leaf mold; (3) clay; (4) two-thirds clay, one-third leaf mold; (5) loam; (6) two-thirds loam, one-third leaf mold; and (7) one-third loam, one-third sand, and one-third leaf mold. Plant the same quantity of wheat, peas, or some other quick-growing plant in each pot and keep all under equal conditions in the sunlight, giving all an equal quantity of water, using sample 7 as a guide for the need of water.

Record and *report:* Have each student make a record of the results of the two tests and answer the following questions in his report: What is the effect of organic matter on the actual weight of soils? Why does organic matter increase the water-holding capacity of both sand and clay? Why do barnyard and green manures make soils

easier to work? In what other ways does organic matter increase the productiveness of soils?

LESSON 9.—*Germ Life in the Soil.*

1. Nature of bacteria.
2. Relation to organic matter.
3. Relation to nitrogen.
4. Conditions essential to growth.

Illustrative material: Charts showing forms of bacteria and nitrogen cycle.

LESSON 10.—*Classification of Soils.*

1. Basis of classification.
2. Characteristics of soil ingredients.
3. Humid and arid soils.
4. Soil surveys of United States Department of Agriculture.

Illustrative material: Soil-survey maps.

Special reference: Soil surveys of Bureau of Soils, United States Department of Agriculture. (Secure survey of county or area in which school is located.)

EXERCISE 8.—*Collection of Local Soil Types.*

Purpose: To gain practice in taking soil samples and to secure material for further study.

Directions: If a soil survey has been made of the region in which the school is located, the map which accompanies the report should be used to determine the principal soil types of the district. If no survey has been made, soils should be collected which represent general types as the clay, sand, loam, and leaf mold suggested for Exercise 9. Students should be impressed with the necessity for great care in taking samples which may be sent away for analysis.

In taking samples of soil at any great depth a soil auger is necessary. Suitable augers may be purchased, or one may be made by welding a $\frac{1}{2}$-inch gas pipe with a cross bar to a $1\frac{1}{2}$-inch wood auger. One yard of oilcloth will make four square pieces suitable to receive the samples as they are removed from the borings.

Borings are made by holding the auger in a vertical position, bearing down upon it and turning until the point has penetrated the ground to a depth of 2 or 3 inches. In pulling the auger out a section of soil comes out in much the same condition as it existed when in place. The process of boring a few inches out at a time is repeated until the desired depth of 3 feet, 6 feet, or more is reached.

To ascertain the character of and variations in the material from the surface downward it is necessary to bore only a few inches at a time, not to exceed 6 inches in even the lighter soils, for the reason that important changes of color and other characteristics are otherwise likely to be overlooked. It is very essential that all variations in color, texture, and structure, and the occurrence of other properties within the 3-foot or 6-foot section, as the case may be, should be

carefully studied. Each sample should be designated by a letter or number to correspond with one in the report.

Record and *report:* Notes should be made of the time and place of the taking of the samples as well as detailed observations, as suggested above. If the sample is taken in uncultivated land, the nature of the native vegetation should be noted. If taken in a cultivated field, whatever is known of the previous cropping should be noted and those crops named which appear in the district to be best suited to the type of soil. The lay of the land and the nature of the underlying strata should be noted wherever possible. A written report should accompany each section of samples.

NOTE.—It will be useful in connection with both class and laboratory work to have as an exhibit in the agricultural museum columns of the representative types of the soils of the school district. These columns may vary in length from 1 to 10 feet, according to the depth of the soil. Glass tubing 1 to 2 inches in diameter may be secured for this purpose. Separate jars for each foot of soil should be used in collecting and for laboratory samples. Pint fruit jars serve well for this purpose.

LESSON 11.—*Relation of Soil Type to Crops.*

1. Adaptation of crops to soil.
2. Crops suited to leading soil types.

Illustrative material: Leading soil types of district. (To be used in Lesson 12 also.)

LESSON 12.—*Management of Soil Types.*

1. Management of light soils.
2. Management of heavy soils.

EXERCISE 9.—*A Comparative Study of Soil Types.*

Purpose: To study further the effects of the chief soil ingredients upon the physical nature of soils.

Directions: Secure samples of clay soil, sandy soil, loam, and leaf mold on the same day and keep dry in bottles until used. Note the color of each. Weigh 4 ounces of each sample and spread in shallow pans until thoroughly dry, then weigh again. The difference in weight of the sample before and after drying represents the amount of moisture which can be removed in ordinary evaporation. Take 1 ounce of each of the dry samples and heat at a high temperature in an iron pan or a large iron spoon until everything that will burn has disappeared. Weigh each sample again. The difference in weight will show approximately the amount of organic matter in each. Rub each sample with the fingers and examine with a hand lens, noting the comparative fineness of grains. Make about 1 ounce of each sample plastic with water and note comparative stickiness. Mold each of these samples into a ball, put away to dry, and then note effect of drying upon its plasticity. Saturate a small canful of each sample with water, put away to dry, noting how long it takes each sample to dry and to what extent there has been shrinkage.

To determine the relative weights of the soils use a can containing about a quart, the volume of which may be determined by the students. (Square cans are made especially for the purpose.) Weigh the empty can and then weigh it filled with each sample of soil in turn after it has been settled by jarring and made level by scraping off the top with the sharp edge of a ruler. Deduct the weight of the can to ascertain the weight of the soil. Compute the volume of the can and figure the weight of a cubic foot of each sample.

Record and *report:* In making a record of these tests the following form may be used to tabulate results:

Comparison of soil types.

Kind of soil.	Color.	Amount of moisture.	Amount of organic matter.	Relative fineness of grains.	Relative plasticity.	Effect of water.	Weight of cubic foot.
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....

LESSON 13.—*Purposes of Cultivation.*

1. Preparation of seed bed.
2. Control of weeds.
3. Tillage in relation to fertility.
4. Tillage in relation to moisture.

LESSON 14.—*Conservation of Moisture.*

1. Amounts of water used by plants.
2. Losses by evaporation.
3. The soil mulch.

EXERCISE 10.—*Rise of Capillary Water in Soils.*

Purpose: To determine the height and comparative rapidity of the rise of capillary water in soils of different types.

Directions: Fasten securely in a rack four glass tubes 3 feet long and 1 inch in diameter. After tying cheesecloth over the lower ends, fill the tubes with the following kinds of soil, respectively: Clay, sand, loam, and leaf loam. The lower ends of the tubes should be immersed to a depth of 1 inch in a pan or glasses kept filled with water. Note the time the test is started and the height to which the water has risen in each tube at the end of the following periods: Ten minutes, 30 minutes, one hour, one day, three days, and six days.

Record and *report:* Each student should tabulate the results of his observation, and in a written report to accompany the table answer the following questions: In which soil does the water rise the highest? In which does it rise most rapidly? Which soil has the greatest capacity for capillary water? Upon what factors does the

rise of capillary water depend? Of what practical importance is the relation of capillary water in soils to the farmer? How will it affect his management of soils of different types?

NOTE.—As a preliminary to this exercise capillarity may be demonstrated to the class by dipping a cube of sugar in water colored with ink.

EXERCISE 11.—*Use of Water by Plants.*

Purpose: To show how plants give off moisture and to give an idea of the amount of water used by plants.

Directions: Start a pea vine or some other plant which will grow vigorously in a flower pot. After the plant is growing well cover the top of the pot with a piece of cardboard somewhat larger than the top of the pot, cutting a slit in the board for the plant. Seal the slit with pitch, wax, or tallow so that no moisture can evaporate from the soil. Cover the plant with a glass jar and set in a warm, sunny place. If the jar is cooled by wrapping it for a minute or two in a cloth wrung out of cold water, moisture will condense on the inner surface of the glass.

To determine the quantity of water used, the same plant may be used if there is a space to hold water between the surface of the soil and the cardboard. Water should be applied as needed, lifting the cardboard to apply it. Weigh all water given, keeping up the test for a month or as much longer as convenient. At the end of the test dry the plant thoroughly, weigh it, and then determine the relation between the dry matter and the water needed to produce it.

Record and *report:* Each student should make a record of the water used and make a written report of results in which he should answer the following questions: Where does the water on the glass come from? How is this water given off by plants? Is all water absorbed by the roots given off by the leaves? What is the function of water in the plant? About how much water is used to make a pound of dry matter in the plant tested? How does this test agree with published reports?

EXERCISE 12.—*Effect of Mulching on Conservation of Moisture.*

Purpose: To test the efficiency of different mulches.

Directions: Six cans or pots of equal size should be filled with equal quantities of loam soil of uniform grade. Fill within 2 inches of the top and wet thoroughly with equal quantities of water. These cans should then be treated with mulching material as follows: (1) Left as a check, (2) cover with 1½ inches of soil and pack it down, (3) cover with the same amount of the same kind of soil, but keep it loose by stirring from time to time, (4) cover with 1½ inches of gravel, (5) cover with 1½ inches of fine road dust, and (6) cover with 1½ inches of chaff, sawdust, or bits of dry leaves. Keep all cans under similar conditions. Weigh morning and evening for five days.

Record and *report:* Each student should keep a record of the weights of the cans, tabulating results to show loss by days and the total loss in a comparative way. In his report he should explain why the various forms of mulching check evaporation and make application of the principles to results in field practice.

NOTE.—Preliminary to this exercise the effects of a mulch may be demonstrated by putting powdered sugar on the top of a cube dipped in colored water, as suggested in connection with Exercise 10.

LESSON 15.—*Tillage Implements.*

1. The plow and its use.
2. Harrows and cultivators and their use.
3. Rollers and planters and their use.
4. Hoes and other hand tools.

Illustrative material: Catalogues of implement dealers (or a visit to such dealers).

LESSON 16.—*Drainage.*

1. Drainage of farm land a national problem.
2. Benefits of drainage.
3. Economics of drainage.

LESSON 17.—*Drainage*—Continued.

1. Drainage systems.
2. Tile drainage.

Special reference: Tile Drainage on the Farm, Farmers' Bulletin 524.

EXERCISE 13.—*Influence of Drainage on Plant Growth.*

Purpose: To show the effect of an outlet for surplus water.

Directions: Use two plants nearly identical in size and variety in pots of the same size filled with similar soil. Stop up the hole in the bottom of one pot with wax and leave the other open with some pieces of broken flower pot or a layer of coarse gravel covering the bottom of the pot. Give the plants an abundant supply of water, the same amount to each plant. The temperatures of the soil of each pot should be taken by placing the bulb of a thermometer 2 inches below the surface and taking readings each day. After the effects of a lack of drainage are noted on one of the plants the pots should be changed, care being taken not to disturb the soil about the roots of the plants, the watering continued, and the effect noted.

Record and *report:* A record should be made of the effects of the water upon the plants and the temperature of the soil. A written report should explain the cause of the condition of the plants in answer to the following questions: Why do most plants fail to grow well in undrained soil? What has the temperature of the soil to do with the difference in growth of the two plants? What is the effect of changing conditions with regard to drainage? How may the principles and practice of this exercise be applied to field conditions?

LESSON 18.—*Erosion of Soils.*

1. Nature of erosion.
2. Problem of erosion in the South.
3. Conditions influencing erosion.
4. Wind erosion.

Illustrative material: An erosion model. (See U. S. Dept. of Agriculture, Office of Expt. Stas. Circ. 117, Working Erosion Model for Schools.)

LESSON 19.—*Prevention of Erosion.*

1. Relation to crops grown.
2. Relation to soil management.
3. Contour planting.
4. Terracing.

Special references: The Mangum Terrace in its Relation to Efficient Farm Management. U. S. Dept. of Agriculture, Bur. Pl. Indus. Circ. 94. An Effective Method of Preventing the Erosion of Hill Land. U. S. Dept. of Agriculture, Bur. Pl. Indus. Circ. "A" 78. Economic Waste from Soil Erosion. U. S. Dept. of Agriculture Yearbook, 1913.

EXERCISE 14.—*A Field Study of Erosion and Methods of Control.*

Purpose: To make students familiar with the causes of erosion and the most efficient methods of control which will apply to local conditions.

Directions: In connection with a study in the classroom of soil erosion and methods of control the class should visit a near-by field that has become gullied and bare through washing, and on the same trip, if possible, visit farms upon which erosion has been prevented by methods best suited to the section.

Record and *report:* Each student should make a written report of the trip in which he should bring out, in addition to any notes of special interest, answers to such of the following questions as may apply: Why has the washing been especially bad upon the field visited? At what season of the year is the washing the worst? What methods of prevention or control would have been best suited to this field? To what extent is erosion prevented on the farms visited by proper plowing and cultivation? What have the methods of planting to do with erosion and its prevention? What have the systems of cropping and the kind of crops to do with succession in prevention and control of erosion? What kind of terraces appear to be best suited to this section? To what extent are open ditches and tile drains used to advantage? What suggestions do you have for improvement of the methods used?

LESSON 20.—*Nitrogen as Plant Food.*

1. Nature of the element.
2. Why nitrogen is valuable.
3. Sources of nitrogen in the soil.
4. Nitrification and denitrification.
5. Relation to leguminous plants.

LESSON 21.—*Phosphorus and Potassium.*

1. As limiting factors in plant growth.
2. Nature of the elements and their compounds.
3. Amount in typical soils—availability.

LESSON 22.—*Soil Fertility.*

1. Views on what fertility is.
2. Relation to crop production.
3. Relation to water supply.
4. Relation to physical condition of soil.

LESSON 23.—*Maintaining Soil Fertility.*

1. History of American agriculture with reference to maintenance of fertility.
2. Relation of soil fertility to national prosperity.
3. Our duty toward generations to come.
4. Relation to farm management.

Special references.—The following Farmers' Bulletins: 257, Soil Fertility. 406, Soil Conservation.

LESSON 24.—*Commercial Fertilizers.*

1. Development of the fertilizer trade.
2. Nitrogenous fertilizers.

Illustrative material: Samples of fertilizing materials and commercial fertilizers. (To be used also in lessons to follow.)

LESSON 25.—*Commercial Fertilizers*—Continued.

1. Potash fertilizers.
2. Phosphate fertilizers.
3. Mixed fertilizers.

LESSON 26.—*Commercial Fertilizers*—Continued.

1. Buying fertilizers.
2. Home mixing of fertilizers.
3. Applying fertilizers.

Special references.—The following Farmers' Bulletins: 44, Commercial Fertilizers. Composition and Use; 394, Farm Practice in the Use of Commercial Fertilizers in the South Atlantic States.

EXERCISE 15.—*Examination of Commercial Fertilizers.*

Purpose: To aid students in becoming familiar with the form and value of common fertilizing materials.

Directions: Secure samples of the following fertilizing materials in glass jars to be properly labeled for future study and use in the laboratory:

Nitrogenous fertilizers: Sodium nitrate, ammonium sulphate, cottonseed meal, linseed meal, dried blood, tankage, fish scrap, guano.

Phosphatic fertilizers: Bone meal, rock phosphate, acid phosphate, basic slag.

Potassium fertilizers: Muriate of potash, potassium sulphate, wood ashes, tobacco stems.

Secure also samples of as many of the brands of commercial fertilizers as are commonly sold upon the local market. After the stu-

dents have become familiar with the common fertilizing materials they should examine the commercial brands to determine, if possible, of what they consist, and to determine their value.

Record and *report:* Each student should describe each of the fertilizing materials and state its source and value. After deciding upon a certain value or unit for the available plant food contained, the market value of each fertilizer sold on the local market should be determined.

NOTE.—In connection with a study of fertilizers in classroom and laboratory a number of problems should be assigned in which the students work out the value of certain fertilizers when applied to the land.

EXERCISE 16.—*Effects of Fertilizers upon Plant Growth.*

Purpose: To demonstrate to the students the effect of commercial fertilizers on local soils.

Directions: Secure unproductive soil of the most common type in the district. (If more than one type is common, the test may be duplicated.) Supply fertilizer to five 8-inch flower pots filled with this soil, as follows: (1) Left as a check; (2) add 5 grams of a complete fertilizer containing from 2 to 3 per cent nitrogen, 8 to 12 per cent available phosphoric acid, and 2 to 5 per cent potash; (3) same as 2 without the nitrogen; (4) same as 2 without the phosphoric acid; and (5) same as 2 without the potash. The fertilizer should be mixed thoroughly with the soil in the upper half of the pot. Moisten the soil with rain water and plant six grains of wheat in each pot. Keep moist in a warm, sunny place and note development of the plants for at least one month.

Record and *report:* Each student should keep a record of the growth of the grain in the several pots and make a written report of the test in which he makes explanation of the difference in growth.

NOTE.—If the school owns land or has use of land near the school, a number of plats may be used profitably for testing fertilizers sold in the community and to demonstrate to the students the effects of fertilizers on the growth of various crops.

EXERCISE 17.—*Home Mixing of Fertilizers.*

Purpose: To apply principles relating to the application of fertilizers and to give practice in their mixing.

Directions: The value of this exercise will depend to a great extent upon the amount of material available and its application to local needs. Each student should have an opportunity to participate. If the school does not own land upon which commercial fertilizers are to be applied, it may be possible for the class to do the mixing for some patron of the school. The most popular complete fertilizer on the local market should be duplicated as far as its

essential ingredients are concerned and such mixtures as are needed for the important local crops prepared. All ingredients should be weighed accurately.

Record and *report:* Each student should keep a record of the weights and percentage composition of the materials used and compute the cost in comparison with the ready-mixed fertilizers sold on the market.

NOTE.—In connection with this exercise the students should submit formulas of other mixtures which would prove economical.

LESSON 27.—*Barnyard Manure.*

1. Benefits of barnyard manure.
2. Comparative value of different manures.
3. Factors influencing the value.

LESSON 28.—*Barnyard Manure*—Continued.

1. Care and management of manure.
2. Applying manure to the land.

Special references: Barnyard Manure, Farmers' Bulletin 192; Farm Manures and Fertilizers, U. S. Dept. of Agriculture, States Relations Service Doc. 30, Ext. S. "A" 77.

EXERCISE 18.—*A Field Study of the Care and Use of Barnyard Manure.*

Purpose: To impress upon the minds of the students the results of proper care and use of barnyard manure in contrast with the results of improper use.

Directions: The class should visit a farm where manure is left in open piles to leach away. In making a visit to any farm where improper methods are to be noted, judgment and tact must be used or offense will be given. It may be necessary for the class to merely make a casual observation in passing such a farm on the way to visit a farm where favorable comments may be made. In visiting a farm where proper methods are used in caring for manure the students should observe the effect on the growing crops and upon the farm as a whole.

Record and *report:* Each student should take notes upon what he sees and make a written report. Answers to the following questions should be included in the report: What is your estimate of the value of a ton of barnyard manure in the district? In what ways may this value be lessened? What is the most practical means of conserving the liquid manure? How may leaching be prevented? What is the most efficient method of removing manure from the stable? Is it practical to remove it to the land each day throughout the year? Is a manure spreader a paying investment for the farms visited? What is the best means of caring for the manure on these farms?

LESSON 29.—*Green Manures and Cover Crops.*

1. Value as source of humus.
2. Value as protection from erosion.
3. Legumes as a source of nitrogen.

LESSON 30.—*Green Manures and Cover Crops*—Continued.

1. Legumes suitable for green manuring.
2. Cereals suitable for green manuring.
3. Management of green manures and cover crops.

Special reference: Leguminous crops for green manuring, Farmers' Bulletin 278.

LESSON 31.—*Renovation of Worn-out Soils.*

1. Why farms are abandoned.
2. Effects of one-crop system.
3. Application of previous lessons.

Special reference: Renovation of worn-out soil, Farmers' Bulletin 245.

LESSON 32.—*Acid Soils.*

1. Causes of acidity.
2. Testing for acidity.
3. Remedies.
4. Crop adaptation to acid soils.

Illustrative material: Chemicals to demonstrate acids, bases, and salts.

LESSON 33.—*Lime and Other Amendments.*

1. Benefits of liming.
2. Soils that need liming.
3. Forms of lime and their use.
4. Gypsum and other amendments.

Illustrative material: Samples of different forms of lime.

Special reference: The Liming of Soils, Farmers' Bulletin 77.

EXERCISE 19.—*Testing Soil for Acidity.*

Purpose: To give students practice in the use of the litmus test.

Directions: Samples of soil should be taken from a field known to be acid. In applying the litmus test care should be taken to avoid handling the litmus paper with sweaty hands. Clean dishes should be used in mixing the samples of soil into a paste. Use distilled water if obtainable. After the soil has been moistened and the surface made smooth, pieces of blue litmus paper should be pressed against the smooth surface with a clean knife. The degree of acidity may be determined to some extent by the time required for the paper to turn red and the degree of coloring. After soil known to be acid is tested, soils of origin unknown to the students should be tested, each student having an opportunity to apply the test. In regions where alkali soils abound, red litmus paper should be used to test such soils.

Record and *report:* Each student should make a written report of the test, including the taking of the sample. The following questions are suggestive: What are indications of an acid soil? What is the

object of making a test? Why is it important to use clean utensils? Why should the degree of acidity be determined? The report should include the time taken for each test to work and a statement of the relative shades of the slips.

EXERCISE 20.—*Effects of Lime on Soil.*

Purpose: To show that lime will correct the acidity of acid soils and aid in the crumbling of clay soils.

Directions: Mix half an ounce of air-slaked lime with a pound of soil which has been found to be acid by the litmus test. Apply the test again and note results.

Treat four pans of clay soil, each pan holding 1 pound, as follows: (1) Left as a check, (2) one-half ounce air-slaked lime, (3) 1 ounce, and (4) 2 ounces. Mix the lime thoroughly with the soil, leaving no lumps. Saturate each with water and leave to dry without stirring. After drying note the cracks which have been formed on top and then study the physical condition, noting hardness and the tendency to crumble.

Record and *report:* Each student should report effect of lime on acidity, giving reasons. Drawings should be made of the tops of the samples of clay soil after they have dried, these drawings to accompany a description of the effect of the lime on the physical condition of the soil.

NOTE.—If the school has the use of land in a section where the soils need liming, field tests should be made to determine the amount needed for important crops.

LESSON 34.—*A Local Soil Survey.*

1. Value of soil surveys.
2. Instructions regarding the taking of samples.

Illustrative material: A map of the county or district showing soil types.

LESSON 35.—*Mechanical Analysis of Soils.*

1. Value of such an analysis.
2. Methods.

Illustrative material: Charts or samples showing mechanical analysis.

LESSON 36.—*Chemical and Bacteriological Analyses.*

1. Value of such analyses.
2. Methods.

Illustrative material: Charts showing analyses of representative types.

FIELD CROPS.

(Fifty-nine lessons, 15 double periods for practical work. Home projects.)

References: Any of the general texts in field crops. Price List 44, U. S. Public Documents Relating to Plant Life. (For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C.)

LESSON 1.—*Introduction.*

1. Classification of field crops.
2. Statistics and relative value.
3. Selection of crops.

Special references on corn.—The following Farmers' Bulletins: 8, Corn Culture for the South; 298, Food Value of Corn and Its Products; 303, Corn-Harvesting Machinery; 313, Harvesting and Storing Corn; 400, A More Profitable Corn-Planting Method; 414, Corn Cultivation; 537, How to Grow an Acre of Corn; 553, Pop Corn for the Home; 554, Pop Corn for the Market; 617, School Lessons on Corn.

LESSON 2.—*History and Importance of Corn.*

1. Origin and history.
2. Development of corn production.
3. Present status of industry.
4. Corn products.

Illustrative material: An exhibit of corn products.

LESSON 3.—*Classification and Varieties of Corn.*

1. Botany of the corn plant.
2. Races of corn.
3. Varieties for the South.

Illustrative material: Corn plants in different stages; specimen ears of different races.

LESSON 4.—*Judging and Exhibiting Corn.*

1. The score card for corn.
2. Selecting corn for exhibits.

Illustrative material: Score cards. Perfect and imperfect ears.

EXERCISE 21.—*Care of Seed Corn.*

Purpose: To secure material for future use and to give practice in efficient methods.

Directions.[1]

EXERCISE 22.—*Corn Judging.*

Purpose: To develop skill in selection of seed corn.

Directions.[1]

LESSON 5.—*Improvement of Corn.*

1. Importance of selection.
2. Methods of corn breeding.
3. Seed testing.

Illustrative material: Specimens of ears showing stages in improvement; different types of testers.

EXERCISE 23.—*Testing Seed Corn.*

Purpose: To develop skill in testing and to ascertain the most efficient method.

Directions.[1]

[1] Directions for these three exercises will be found in the Agricultural Education Monthly, Vol. II, No. 6, Teaching Corn Production in Secondary Schools.

LESSON 6.—*Corn Planting.*

1. Preparation of seed bed.
2. Time of planting.
3. Depth of planting.
4. Planting machines.
5. Systems of planting.

LESSON 7.—*Soils and Fertilizers for Corn.*

1. Types of soils best suited to corn.
2. Improvement of soils.
3. Corn in the rotation.
4. Fertilizers for corn.

LESSON 8.—*Cultivation of Corn.*

1. Methods of tillage.
2. Tillage implements.
3. Control of weeds and moisture.

Special reference: Farm Practice in the Cultivation of Corn, U. S. Dept. of Agriculture Bulletin 320.

LESSON 9.—*Corn Enemies and Their Control.*

1. Fungus diseases.
2. Insect pests.
3. Other enemies.

Illustrative material: Mounted specimens of insects and diseases.

LESSON 10.—*Harvesting and Marketing Corn.*

1. Harvesting methods and machinery.
2. Marketing the crop.
3. Storing corn.

LESSON 11.—*Oats.*

1. History and importance.
2. Botany of the plant.
3. Types of oats and varieties for the South.
4. Soils and fertilizers.
5. Preparation of land and planting.
6. Care and cultivation of crop.
7. Harvesting, storing, and marketing.
8. Uses.
9. Enemies.

NOTE.—The above outline may be adapted to lessons covering crops to follow.

Illustrative material: Specimens showing types and varieties of oats and all grains which follow.

Special references.—The following Farmers' Bulletins: 420, Oats: Distribution and Uses; 424, Oats: Growing the Crop; 436, Winter Oats for the South.

EXERCISE 24.—*Treating Seed Oats for Smut.*

Purpose: To give students practice.

Directions: If the school is not to plant oats upon its own land, it may be possible for the class to treat the seed of some farmer in the neighborhood. As the formalin treatment is most generally recommended, the following directions are given for this method: Spread

the seed out upon a clean floor and sprinkle thoroughly with a solution of 1 pound of formalin to 40 gallons of water. The seed should be shoveled over until it is well moistened and then covered with blankets or canvas and allowed to stand for several hours. It can then be sown at once or spread out in a clean place to dry.

NOTE.—In connection with this exercise it will be profitable to have a germination test made of samples taken before and after treatment to ascertain if the formalin has any effect upon the vitality of the seed.

LESSON 12.—*Wheat.*

Special references.—
Improvements in Wheat Culture, U. S. Dept. of Agriculture Yearbook, 1896.
Winter Wheat in the Cotton Belt, Office of Secretary of Agriculture, Special Circular.
Growing Hard Spring Wheat, Farmers' Bulletin 678.
Varieties or Hard Spring Wheat, Farmers' Bulletin 680.

LESSON 13.—*Rye.*

Special reference: Rye in the Cotton Belt, Office of Secretary of Agriculture, Special Circular.

LESSON 14.—*Barley.*

Special references.—The following Farmers' Bulletins: 427, Barley Culture in the Southern States, 443, Barley: Growing the Crop; 518 Winter Barley.

LESSON 15.—*Rice.*

Special references.—The following Farmers' Bulletins: 417, Rice Culture; 673, Irrigation Practice in Rice Growing.

EXERCISE 25.—*Collection and Study of Small Grains.*

Purpose: To familiarize students with varieties of grains suited to local conditions.

Directions: The collection and study of small grains may be carried on as extensively as time permits and as the agricultural interests of the students and community demand. The school should have an exhibit of types and varieties of grains as a part of its museum and laboratory equipment. While such exhibits may be purchased, these should be used chiefly as a means of suggestions for work to be done by students and as an aid in checking upon the naming of varieties. Each student may be assigned the collection and mounting of 10 varieties of a certain kind of cereal. Directions for this work may be obtained in Farmers' Bulletin 586, Collection and Preservation of Plant Material for Use in the Study of Agriculture.

Record and *report:* Students should make use of printed outlines in writing descriptions and reporting upon quality.

NOTE.—This work may include the use of a score card in judging those grains most important in the district.

LESSONS 16 AND 17.—*The Sorghums.*

Special references.—

Sorghum for Forage in the Cotton Belt, Office of Secretary of Agriculture, Special Circular.

The Grain Sorghums, U. S. Dept. of Agriculture Yearbook, 1913.

The following Farmers' Bulletins: 246, Saccharine Sorghums for Forage; 287, Nonsaccharine Sorghums; 448, Better Grain-Sorghum Crops; 458, Best Two Sweet Sorghums for Forage; 477, Sorghum Sirup Manufacture; 552, Kafir as a Grain Crop; 686, Uses of Sorghum Grain.

EXERCISE 26.—*A Study of Types and Varieties of Sorghums.*

Purpose: To familiarize students with a class of field crops some of which may prove of great value to local agriculture.

Directions: The school should have a fairly complete collection of the types and varieties of sorghums as heads and thrashed material. The collection and mounting of varieties grown locally should be assigned to students. The collection may be completed by purchase, or by exchange with other southern schools, of material from firms which supply agricultural laboratories. The varieties of sorghum may be grouped under the following heads: (1) Saccharine, including the varieties used for sirup; (2) nonsaccharine, or grain sorghums, including kafir, milo, and other durras, and such miscellaneous varieties as the kaolings, shallu, and darso; and (3) broom corn.

The following outline may be used in the description of each variety: (1) Head; length, circumference, and shape; (2) seed; size, shape, color, hardness; and (3) glumes; hairy or smooth, color, length.

If score cards are not obtainable from the State agricultural college or State department of agriculture, the class should make up score cards for judging both head samples and grain samples. Practice in judging may follow according to the time available and in accordance with the importance of the crop.

NOTE.—If the sorghums are not adapted to the section in which the school is located, the same study may be made of some other group of forage crops which is little known and which may give promise, such as the millets.

LESSON 18.—*Sugar Cane.*

LESSON 27.—*A Study of Sirup Making.*

Purpose: To familiarize students with modern methods in making cane sirup.

Directions: The class should visit a farm or factory where the most modern methods are in vogue. The teacher should make arrangements before the visit so that the time may be spent most profitably in a study of the processes from the grinding of the cane to the canning of the sirup.

Record and *report:* Each student should make a record of items of interest and write a report of the trip in which the following questions are answered: What are the requirements of good sirup? What equipment is needed? Discuss the degrees of efficiency of roller mills in connection with a description of the grinding process. What kind of evaporator is best suited to farm use? What is the most efficient method of straining the juice? Discuss the use of a Baumé hydrometer in connection with the boiling of the sirup. What factors are to be considered in connection with a prevention of the sirup crystallizing? Discuss the use of lime in connection with removal of impurities. How is sulphur used? What are the fundamental principles which underly the canning of sirup and other food products? What factors will determine the price received for the product?

NOTE.—This exercise may be adapted to a study of the making of sorghum sirup.

LESSONS 19 AND 20.—*Tobacco.*

Special references.—The following Farmers' Bulletins: 60, Methods of Curing Tobacco; 120, The Principal Insects Affecting the Tobacco Plant; 343, The Cultivation of Tobacco in Kentucky and Tennessee; 523, Curing Tobacco; 571, Tobacco Culture.

EXERCISE 28.—*Production of Tobacco Plants.*

Purpose: To give students practice in management of a seed bed and to test depths for planting.

Directions: Each student should participate in the preparation and planning of a seed bed for tobacco and care for the plants until they are ready to set out in the field. The work may also include the setting of the plants wherever it is possible. A portion of the seed bed should be divided to test depth of planting, as follows: (1) On the surface, (2) barely covering seeds with soil, and (3) one-half inch deep. If it is not possible to have seed beds out of doors, small flats may be used in the sunny windows of the laboratory or classroom.

NOTE.—This exercise should be omitted where tobacco is not an important crop.

LESSONS 21, 22, AND 23.—*Sweet Potatoes.*

Special references.—The following Farmers' Bulletins: 324, Sweet Potatoes; 548, Storing and Marketing Sweet Potatoes.

EXERCISE 29.—*Propagation of Sweet Potatoes.*

Purpose: To give students practice in the production of plants and to furnish material for a study of the sweet-potato plant.

Directions: This exercise should provide practice to all students in each of the following operations: (1) Selection of seed, (2) making of hotbed, (3) planting and care of bed, and (4) drawing and

setting of plants. Directions for all these operations may be obtained from Farmers' Bulletin 324, Sweet Potatoes.

NOTE.—The method of propagation should be adapted to the section in which the school is located.

LESSON 24.—*Potatoes.*

Special references.—The following Farmers' Bulletins: 35, Potato Culture; 91, Potato Diseases and Their Treatment; 407, The Potato as a Truck Crop; 533, Good Seed Potatoes and How to Produce Them; 544, Potato Tuber Diseases.

LESSON 25.—*Cassava and Okra.*

Special references.—The following Farmers' Bulletins: 167, Cassava; 232, Okra.

LESSON 26.—*Miscellaneous Field Crops.*

1. Rape.
2. The cabbage family.
3. Other crops which may be of local importance.

Special reference: Rape as a Forage Crop, Farmers' Bulletin 164.

LESSON 27.—*Root Crops.*

1. Stock beets of different types.
2. Turnips, carrots, and parsnips.
3. Jerusalem artichokes.
4. Miscellaneous root crops for the South.

Special references.—

Promising Root Crops for the South, U. S. Dept. of Agriculture, Bur. Pl. Indus. Bul. 164.

Sugar Beet Growing under Humid Conditions, Farmers' Bulletin 568.

Special references on cotton.—

Bulletins and circulars upon the subject obtained from State experiment stations and departments of agriculture.

Improvement of Cotton by Seed Selection, U. S. Dept. of Agriculture Yearbook, 1902.

Cotton Improvement on a Community Basis, U. S. Dept. of Agriculture Yearbook, 1911.

Improved Methods of Handling and Marketing Cotton, U. S. Dept. of Agriculture Yearbook, 1912.

Production of Cotton under Boll Weevil Conditions, U. S. Dept. of Agriculture, Bur. Pl. Indus. Circ. "A" 71.

The Cotton Plant: Its History, Botany, Chemistry, Culture, Enemies, and Uses, U. S. Dept. of Agriculture, Off. Expt. Stas. Bulletin 33.

The following Farmers' Bulletins: 36, Cotton Seed and Its Products; 285, Advantage of Planting Heavy Cotton Seed; 286, Comparative Value of Whole Cotton Seed and Cottonseed Meal in Fertilizing Cotton; 290, The Cotton Bollworm; 302, Sea Island Cotton: Its Culture, Improvement, and Diseases; 326, Building up a Run-down Cotton Plantation; 333, Cotton Wilt; 364, A Profitable Cotton Farm; 500, Control of the Boll Weevil; 501, Cotton Improvement Under Weevil Conditions; 512, The Boll-weevil Problem; 601, A New System of Cotton Culture and Its Application; 625, Cotton Wilt and Root Knot.

LESSON 28.—*The Cotton Industry in the South.*

1. History and statistics.
2. Relation of cotton to southern agriculture.
3. Present status of the industry.

LESSON 29.—*Uses of Cotton and Its Products.*

1. Cotton lint—a source of material for clothing.
2. Cotton seed—a source of food for man, beast, and soil.

Illustrative material: An exhibit of cotton and its products.

LESSON 30.—*General Characteristics and Structure of Cotton.*

1. Botany of the cotton plant.
2. Composition of different parts of the plant.
3. Classes and grades of lint.

LESSON 31.—*Types and Varieties of Cotton.*

1. Species and types.
2. Groups and varieties of American Upland.

Illustrative material: Pictures and mounted specimens showing types and varieties.

EXERCISE 30.—*A Study of Cotton Varieties.*

Purpose: To familiarize students with the varieties of cotton suited to the section.

Directions: Each student should be required to collect, classify, and describe 10 varieties of cotton, or as many of this number as are grown in the school district.

Record and *report:* Notes should be taken regarding the fields from which the specimens are taken. The written descriptions should include: (1) Name of variety and group to which it belongs, (2) size and shape of plant, (3) time of maturity, (4) size and relative number of bolls, (5) length and quality of lint, and (6) yield (record in district).

Reference: Lessons on Cotton for the Rural Common School, United States Department of Agriculture Bulletin 294.

LESSON 32.—*Improvement of Cotton.*

1. Importance of selection.
2. Qualities needing improvement.
3. Methods of cotton breeding.

EXERCISE 31.—*Judging and Selection of Cotton.*

Purpose: To train judgment of students in selecting a variety and in the selection of plants in the improvement of a variety.

Directions: Each student should have practice with a score card to the extent that time will allow. After such practice the student should select the nearest approach to his ideal from a variety common to the district which may be designated by the instructor. This practice is preliminary to selection of seed plants in the field.

Record and *report:* A written report of the field selection should include a description of an ideal plant of the variety selected and

answers to the following questions: Why should an ideal or standard of the variety be kept constantly in mind? What are the principal qualities desired in the plant? What defects are to be guarded against? What qualities in this variety need improvement? Which of these qualities are antagonistic? Which qualities will it be most profitable to strive to improve at this time? How is improvement secured through selection?

NOTE.—The students should be encouraged to use the seed of the plants selected in a breeding plat at home.

LESSON 33.—*Soils and Fertilizers for Cotton.*

1. Soils best suited to cotton.
2. Improvement and renovation of soils.
3. Cotton in the rotation.
4. Fertilizers for cotton.

LESSON 34.—*Planting and Cultivation of Cotton.*

1. Methods of planting.
2. Methods of tillage.
3. Tillage implements.
4. Control of weeds and moisture.

LESSON 35.—*The Mexican Cotton Boll Weevil.*

1. Extent of injury.
2. Injury to the plant.
3. Natural history of the insect.
4. Methods of control.

Illustrative material: Mounted specimens showing life history of boll weevil.

LESSON 36.—*Other Insect Enemies and Diseases of Cotton.*

1. The cotton bollworm.
2. Insects of minor importance.
3. Diseases of the cotton plant.

Illustrative material: Mounted specimens of insects.

LESSON 37.—*Harvesting and Marketing Cotton.*

1. Picking.
2. Ginning.
3. Baling and compressing.
4. The cotton market.

LESSON 38.—*Place of Legumes in Southern Farming.*

1. Botany of the Leguminosæ.
2. A review of symbiosis.
3. Relation of legumes to stock feeding.
4. Relation of legumes to soil feeding.
5. Legumes as food for man.

Illustrative material: Specimens of representative legumes to show flowers and fruit.

Special references.—The following Farmers' Bulletins: 121, Beans, Peas, and Other Legumes as Food; 278, Leguminous Crops for Green Manuring; U. S. Dept. of Agriculture Yearbook, 1897, Leguminous Forage Crops.

LESSON 39.—*Cowpeas.*

Illustrative material: Collection of seed of different varieties of this and crops which follow.

Special references: Cowpeas, Farmers' Bulletin 318; Cowpeas in the Cotton Belt, Office of Secretary of Agriculture Special Circular.

LESSON 40.—*Soy Beans.*

Special reference: Soy Beans, Farmers' Bulletin 372.

LESSON 41.—*Field Peas and Beans.*

Special references.—The following Farmers' Bulletins: 224, Canadian Field Peas; 289, Beans.

LESSON 42.—*Peanuts.*

Special reference: The Peanut, Farmers' Bulletin 431.

LESSONS 43 AND 44.—*The Clovers.*

Bur, red, crimson, alsike, white, sweet, and any other clovers of local importance.

Illustrative material: Mounted specimens of fresh plants of all varieties of clover. Samples of seed of each variety. Same for forage plants which follow.

Special references.—The following Farmers' Bulletins: 123, Red Clover Seed; 441, Lespedeza, or Japan Clover; 455, Red Clover; 485, Sweet Clover; 550, Crimson Clover: Growing the Crop; 579, Crimson Clover: Utilization; 646, Crimson Clover: Seed Production; 693, Bur Clover; 730, Button Clover.

LESSON 45.—*Vetches.*

Special references: Hairy Vetch for the Cotton Belt, Office of Secretary of Agriculture Special Circular. The following Farmers' Bulletins: 515, Vetches; 529, Vetch Growing in the South Atlantic States.

LESSONS 46 and 47.—*Alfalfa.*

Special references.—The following Farmers' Bulletins, 339, Alfalfa; 494, Alfalfa Seed Production.

EXERCISE 32.—*Legume Inoculation.*

Purpose: To give students practice in proper methods of inoculation.

Directions: While this exercise may be conducted with seed sown in flats in the laboratory, it will have greater value if conducted in connection with the seeding of alfalfa or any of the clovers on the school farm or the farm of a neighboring patron. In a district where any legume which gives promise has not been grown extensively a demonstration may be carried out with profit upon plats treated as follows: (1) Without inoculation, (2) inoculated by the soil-transfer method, and (3) inoculated by the pure-culture method. Directions for applying these methods may be obtained from the United States Department of Agriculture, Bureau of Plant Industry Circular 63, Methods of Legume Inoculation, or from the Farmers' Bulletins which treat the growing of the specific crop. Pure cultures for

demonstration purposes may be obtained from the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C. Each student should participate as far as possible in the work.

NOTE.—This exercise may be preceded with profit by a comparative study of the nodules on the various kinds of legumes found in the neighborhood of the school.

LESSONS 48 AND 49.—*The Grasses.*

Bermuda, Johnson, Sudan, Rhodes, timothy, redtop, Kentucky bluegrass, orchard grass, the brome grasses, fescues, and any other grasses of local importance.

Special references.—

Notes on Grasses and Forage Plants of Southeastern States, Agrostology Bulletin 1.

Economic Grasses, Agrostology Bulletin 14.

Some New Grasses for the South, United States Department of Agriculture Yearbook, 1912.

The following Farmers' Bulletins: 361, Meadow Fescue: Its Culture and Uses; 402, Canada Bluegrass: Its Culture and Uses; 605, Sudan Grasses as a Forage Crop.

EXERCISE 33.—*Collection and Study of Grasses.*

Purpose: To familiarize students with varieties of grasses best suited to local conditions.

Directions: Each student should collect and describe two grasses of local importance in addition to the following 10 varieties: Bermuda, Johnson, Sudan, Rhodes, timothy, redtop, Kentucky bluegrass, orchard grass, smooth brome-grass, and meadow fescue. Whenever possible, a sample of seed should accompany the sample of dried grass.

Record and *report:* The following outline from A Laboratory Manual of Cereals and Forage Crops, by Livingston and Stemple, may be followed in writing the descriptions of the grasses:

Field study of perennial grasses.

(Adapted for last of May or first of June.)

Common name_____
Scientific name_____
Place mostly grown_____
Thriftiness: Vigorous, medium, weak_____
Habit of growth:
  Stooling: Very stoloniferous, medium, not_____
  Diameter of plants (average of 10 plants)_____
  Number of plants per square foot for full stand_____
Roots:
  Color: White, brown, red_____
  Depth: Deep or shallow—medium_____

Culms:
- Number per plant (average 10 plants)_____
- Height—inches (average 10 plants)_____
- Position: Erect, decumbent at base, decumbent_____
- Size: Coarse, medium, slender_____
- Shape: Round, elliptical, lenticular_____
- Color: _____

Foliage:
- Abundance: Abundant, medium, scanty_____
- Distribution: Basal foliage, abundant, culm foliage, abundant_____
- Leaf sheath: Smooth, downy, scabrous, split to node, partly split, closed_____

Leaf blade:
- Length—average of 5_____
- Width—average of 5_____
- Position: Erect, ascending, drooping_____
- Midrib: Prominent, medium, indistinct _____
- Surface: Smooth, downy, rough_____
- Color: Shade of green_____

Adapted for: Pasture, hay, both, lawn, etc_____

Inflorescence (if present):
- Shape: Panicle, open and spreading, compressed, spikelike_____
- Length—average of 5_____
- Number of flowers per spikelet_____
- Color: _____

EXERCISE 34.—*Identification of Seeds of Grasses and Legumes.*

Purpose: To familiarize students with common farm seeds.

Directions: After students have become familiar with the seeds of the grasses suggested in Exercise 33, mixtures of the seeds should be made and the students required to separate them. The same requirements may be made with regard to seeds of the following legumes: Alfalfa, sweet clover, red clover, alsike, white clover, bur clover, Japan clover, crimson clover, and yellow trefoil. It will be necessary to give special attention to seeds which look alike, such as alfalfa and sweet clover. A hand lens will be found useful in this work.

Record and *report:* Drawings of the seed magnified about 10 diameters should accompany a brief description of each variety.

LESSON 50.—*The Millets.*

Special references.—The following Farmers' Bulletins: 101, Millets; 168, Pearl Millet.

LESSON 51.—*Meadows.*

1. Management and care of natural meadows.
2. Soils and fertilizers.
3. Meadow mixtures.
4. Establishing and maintaining the meadows.

LESSON 52.—*Hay making.*

1. Time for cutting various forage crops.
2. Cutting and curing.
3. Storing.
4. Market hay.

Special references.—The following Farmers' Bulletins: 312, A Successful Southern Hay Farm; 508, Market Hay; 677, Growing Hay in the South for Market.

LESSON 53.—*Pastures.*

1. Management and care of natural pastures.
2. Soils and fertilizers.
3. Pasture mixtures.
4. Establishing and maintaining the pasture.

Special references.—

Permanent Pastures for the Cotton Belt, Office of Secretary of Agriculture. Special circular.

Meadows and Pastures, Farmers' Bulletin 66.

LESSON 54.—*Crops for Soiling and Silage.*

1. Crops suitable for soiling.
2. Crops suitable for silage.
3. Management of the crops.

Special references.—The following Farmer's Bulletins: 102, Southern Forage Plants; 147, Winter Forage Crops for the South; 300, Some Important Grasses and Forage Plants for the Coast Region.

LESSON 55.—*Rotation of Crops.*

1. History and development of crop rotation.
2. Purposes of crop rotation.

Illustrative material: Chart showing purposes of rotation.

LESSON 56.—*Rotation of Crops*—Continued.

1. Essentials of good rotations.
2. Plans for rotations.

Illustrative material: Maps of farms showing rotation plans.

Special references.—

Cropping Systems for Stock Farms. United States Department of Agriculture Yearbook. Separate, 456.

Planning a Cropping System. United States Department of Agriculture Bur. Pl. Indus. Bul. 102, pt. 3.

Practices in Crop Rotation. United States Department of Agriculture Yearbook, 1902.

Relations Between Rotation Systems and Insect Injury in the South. United States Department of Agriculture Yearbook. Separate, 561, 1911.

LESSON 57.—*Weeds.*

1. Definition of weeds.
2. Importance of weed study.
3. Classification.
4. Damage done by weeds.

LESSON 58.—*Weeds*—Continued.

1. Relation of weeds to cultivation.
2. How weeds spread.
3. Method of eradication.

Illustrative material: Charts showing how some weeds spread.

LESSON 59.—*Important Local Weeds.*

1. Their botany.
2. Methods of control.

Illustrative material: An herbarium of local weeds; a collection of seeds of noxious weeds.

Special references.—The following Farmers' Bulletins: 86, Thirty Poisonous Plants; 188, Weeds Used in Medicine; 279, A Method of Eradicating Johnson Grass; 368, The Eradication of Bindweed or Wild Morning Glory; 382, The Adulteration of Forage Plant Seeds; 464, The Eradication of Quack Grass; 545, Controlling Canada Thistles; 660, Weeds and How to Control Them.

EXERCISE 35.—*Collection and Study of Weeds.*

Purpose.—To familiarize students with the common noxious weeds.

Directions: Each student should be requested to collect and identify 10 weeds. It is preferable that these weeds be brought from the home farm and represent the weeds giving most trouble. If the students have had work in systematic botany a botanical key may be used for identification. Other students may use an illustrated weed manual. From the weeds collected specimens may be selected and mounted as a weed herbarium for the agricultural museum. Such an herbarium will be useful for identifying weeds in the future as well as for study when fresh specimens are not obtainable. Whenever possible a sample of ripe seed should accompany the dried plant.

Record and *report:* A brief description should be given of each weed with an explanation of why it is pernicious and how it may best be controlled. Wherever possible a drawing should be made of the plant when very young.

EXERCISE 36.—Testing farm seeds for impurities.

Purpose: To gain practice in the examination of purchased seed and further practice in the recognition of seeds of grasses, legumes, and weeds.

Directions: Samples of alfalfa, the clovers, and the grasses should be tested by each student for impurities. If the seed sold on the local market does not give the desired practice the instructor should make up mixtures of good seed containing foreign matter and seeds of weeds. Complete directions for this work may be obtained from Farmers' Bulletin 428, Testing Farm Seeds in the Home and in the Rural School.

Record and *report:* A record should be made of the impurities found in each sample which will form the basis of a report showing the relation of the foreign material to the value of the seed.

SUGGESTIONS FOR HOME PROJECTS—FIRST YEAR.

PRODUCTION PROJECTS.

The profitable production of one-half acre or more of one of the following crops: Corn, one of the sorghums, cane, tobacco, potatoes, sweet potatoes, cotton, peas, beans, peanuts, or any annual crop which may be sold for cash.

DEMONSTRATION PROJECTS.

In connection with or in addition to his production project the student may carry out one or more of the following demonstrations: (1) Trying out a crop new to the region, (2) a variety test, (3) working out a rotation, (4) a fertilizer test, (5) use of barnyard manure, (6) use of cover crops and green manures, and (7) improvement by seed selection.

LABORATORY EQUIPMENT FOR SOILS AND CROPS.

(Apparatus and material for 12 students.)

One torsion or Harvard trip balance. (A set of avoirdupois weights will be found useful along with the metric weights.)

One drying oven.

One soil auger.

Twelve alcohol lamps (if gas is not provided).

Twelve tripod lenses.

Four thistle tubes.

Four glass funnels.

Ten 1-inch glass tubes, 4 feet long, with two racks for holding five each.

Two dozen each of the following: Student-lamp chimneys, tin pie plates, paper pie plates, glass tumblers, one-half pint wide-mouthed bottles, quart fruit jars, quart tin cans, 4-inch flower pots, 8-inch flower pots, 8-inch flower pots and soil cans, 4 by 4 inches and 4 inches deep.

Four yards each of oilcloth, canton flannel, cheesecloth, and muslin.

The following boxes to be made by students: One dozen 12 by 12 inches, 8 inches deep; one dozen 12 by 12 inches, 6 inches deep; two dozen 14 by 12 inches, 4 inches deep.

One pound of paraffin and 2 pounds of formalin.

One-half pound of each of the following seeds for testing: Old wheat, fresh wheat, corn, peas, beans, and squash.

One hundred pounds each of clean sand and good loam.

Twenty-five pounds each of gravel, clay, leaf mold, and sawdust.

Ten pounds each of air-slaked lime and dry road dust.

One-fourth pound of lampblack.

Twelve feet of 3-foot wire fencing for corn racks.

Collections to show types and varieties of the following: Corn, small grains, sorghums, and cotton.

Bottles, vials and cardboard for mounting grains, grasses, legumes, and weeds (plants and seeds.)

Score cards for cereals, cotton, etc.

Hotbeds and cold frames or seed beds will be needed for Exercises 28 and 29.

An exhibit of commercial fertilizers and fertilizing materials with sufficient quantities of the latter for the practicum in home mixing.

Each student should have a laboratory notebook.

TEXTS AND REFERENCES FOR SOILS AND CROPS.[1]

1. Bowman, M. L. Corn. Waterloo, Iowa: Author, 1915.
2. Burkett, C. W. and Poe, Clarence. Cotton. Garden City, N. Y.: Doubleday, Page and Co., 1906.
3. Burkett, C. W. Farm Crops. New York: Orange Judd Co., 1910.
4. Burkett, C. W. Soils. New York: Orange Judd Co., 1907.
5. Carleton, M. A. The Small Grains. New York: The Macmillan Co., 1916.
6. Coburn, F. D. The Book of Alfalfa. New York: Orange Judd Co., 1907.
7. Cunningham, J. C., and Lancelot, W. H. Soils and Plant Life. New York: The Macmillan Co., 1915.
8. Duggar, J. F. Southern Field Crops. New York: The Macmillan Co., 1911.
9. Eastman, J. F., and Davis, K. C. Soil Laboratory Manual and Note Book. Philadelphia: J. B. Lippincott Co., 1915.
10. Fletcher, S. W. Soils. Garden City, N. Y.: Doubleday, Page and Co., 1907.
11. Harris, F. S., and Stewart, George. The Principles of Agronomy. New York: The Macmillan Co., 1916.
12. Hitchcock, A. S. A Textbook of Grasses. New York: The Macmillan Co., 1914.
13. Hunt, T. F., and Burkett, C. W. Soils and Crops. New York: Orange Judd Co., 1914.
14. Hunt, T. F. The Cereals in America. New York: Orange Judd Co., 1904.
15. Hunt, T. F. Forage and Fiber Crops in America. New York: Orange Judd Co., 1907.
16. Livingston, George. Field Crop Production. New York: The Macmillan Co., 1914.
17. Lyon, T. L., and Montgomery, E. G. Examining and Grading Grains. Boston: Ginn and Co., 1907.
18. McCall, A. G. Field and Laboratory Studies of Soils. New York: John Wiley and Sons Co., 1915.
19. McCall, A. G. Field and Laboratory Studies of Crops. New York: John Wiley and Sons Co., 1915.
20. Montgomery, E. G. Productive Farm Crops. Philadelphia: J. B. Lippincott Co., 1915.
21. Montgomery, E. G. The Corn Crops. New York: The Macmillan Co., 1913.
22. Piper, C. V. Forage Plants and Their Culture. New York: The Macmillan Co., 1915.
23. Sell, E. S. Agricultural Laboratory Manual—Soils, Boston: Ginn and Co., 1915.
24. Snyder, Harry. Soils and Fertilizers. New York: The Macmillan Co., 1914, 3d ed.
25. Thorne, C. E. Farm Manures. New York: Orange Judd Co., 1913.
26. Vivian, Alfred. First Principles of Soil Fertility. New York: Orange Judd Co., 1908.
27. Vorhees, E. B. Fertilizers. New York: The Macmillan Co., 1916 rev.
28. Whitson, A. R., and Walster, H. L. Soils and Soil Fertility. St. Paul, Minn.: Webb Publishing Co., 1912.
29. Wing, J. E. Alfalfa in America. Chicago. Sanders Publishing Co., 1912.
30. Wing, J. E. Meadows and Pastures. Chicago: Sanders Publishing Co., 1911.

[1] These books are recommended by the Commission on Accredited Schools of the Southern States.

OUTLINE FOR ANIMAL HUSBANDRY—SECOND YEAR.

(One unit.)

TYPES AND BREEDS OF CATTLE.

(Nine lessons; six double periods for practical work.)

Reference: A Secondary Course in Animal Production, U. S. Dept. of Agriculture, Office of Expt. Stas. Circ. 100.

Illustrative material: Charts, pictures, and lantern slides showing types and breeds. Living specimens whenever convenient. (Visits should be made to near-by stock farms. A stereopticon will be found invaluable.)

LESSON 1.—*The Dairy Type.*

1. Purpose of the dairy cow.
2. Form and general appearance.
3. The score card for dairy cattle.
4. Importance of scales and Babcock test as an aid to judging dairy cattle.

Special reference: Judging the Dairy Cow as a Subject of Instruction in Secondary Schools, U. S. Dept. of Agriculture Bul. 434.

PRACTICUMS 1 and 2.—*Judging the Dairy Cow.*

LESSON 2.—*The Jersey.*

(*a*) Origin—history.
(*b*) Characteristics.
(*c*) Production.
(*d*) Official breed organization.

NOTE.—A similar outline may be adapted to all of the important breeds to follow.

LESSON 3.—*The Holstein and Guernsey.*

LESSON 4.—*Other Dairy Breeds.*

1. The Ayrshire.
2. Brown Swiss.

Special reference: Breeds of Dairy Cattle, Farmers' Bulletin 106.

PRACTICUM 3.—*Comparative Study of Dairy Breeds.*

LESSON 5.—*The Beef Type.*

1. Purpose of beef cattle.
2. Form and general appearance.
3. The score card for beef cattle.

PRACTICUM 4.—*Judging the Beef Type.*

LESSON 6.—*English Beef Breeds.*

1. The Shorthorn and Polled Durham.
2. The Hereford.

LESSON 7.—*Scotch Beef Breeds.*

1. The Aberdeen Angus.
2. The Galloway.
3. The West Highland.

LESSON 8.—*Dual-Purpose Cattle.*

1. The dual-purpose type.
2. The Shorthorn of this type.

3. The Red Polled.
4. The Devon.

PRACTICUM 5.—*Judging Dual-Purpose Cattle.*

LESSON 9.—*Market Classes and Grades of Cattle.*

1. Carcass beef—classes.
2. Beef cuts.
3. Beef products.

PRACTICUM 6.—*Judging Local Cattle by Comparison.*

TYPES AND BREEDS OF HORSES AND MULES.

(Seven lessons; four double periods for practical work.)

References.—

Breeds of Draft Horses, Farmers' Bul. 619.
Market Classes of Horses, U. S. Dept. of Agriculture, Bur. An. Indus. Bul. 37.
Selecting and Judging Horses for Market and Breeding Purposes, U. S. Dept. of Agriculture Yearbook, 1902.
Judging Horses as Subject of Instruction in Secondary Schools, U. S. Dept. of Agriculture Bul. 487.

LESSON 1.—*Types of Light Horses.*

1. Function of light horses.
2. Structure and conformation—study of score card.
3. The light harness type.
4. The saddle type.

LESSON 2.—*Breeds of Light Horses.*

1. The Thoroughbred.
2. The American trotter and pacer—Standard bred.
3. The American saddle horse.
4. Coach horses.

PRACTICUM 1.—*Judging Light Horses.*

LESSON 3.—*The Draft Type.*

1. Function of draft horses.
2. Structure and conformation—study of score card.
3. Development of draft type.

LESSON 4.—*Breeds of Draft Horses.*

1. The Percheron.
2. French draft.
3. The Belgian.

LESSON 5.—*Breeds of Draft Horses*—Continued.

1. The Shire.
2. The Clydesdale.
3. The Suffolk.

PRACTICUMS 2 AND 3.—*Judging Draft Horses.*

LESSON 6.—*The Jack and the Mule.*

1. Comparison of mule with the horse.
2. Importance of mules in the South.

LESSON 7.—*The Jack and the Mule*—Continued.

1. Breeds of jacks.
2. Conformation and type of jacks and mules.

PRACTICUM 4.—*Judging Jacks and Mules.*

TYPES AND BREEDS OF SHEEP.

(Three lessons; two double periods for practical work.)

References.—

Domestic Breeds of Sheep in America, U. S. Dept. of Agriculture Bul. 94.
Breeds of Sheep for the Farm, Farmers' Bul. 576.

LESSON 1.—*The Mutton Type.*

1. Relation of type to efficiency in mutton production.
2. The score card for mutton sheep.
3. Description of mutton type.
4. Market grades and classes.

PRACTICUM 1.—*Judging Mutton Sheep.*

LESSON 2.—*The Mutton Breeds.*

1. The Southdown.
2. The Shropshire.
3. The Hampshire.
4. The Suffolk Down.
5. The Oxford Down.
6. The Dorset.
7. The Cheviot.
8. The Cotswold.
9. The Lincoln.

PRACTICUM 2.—*A Study of Wool from Different Breeds and of the Different Market Classes.*

LESSON 3.—*Fine Wool Type and Breeds. Goats.*

1. Classes of merino sheep.
2. General conformation.
3. The American Merino.
4. The Delaine Merino.
5. The Rambouillet.
6. Goats.
   (*a*) The Angora.
   (*b*) Milch goats.

Special reference: The Angora Goat, Farmers' Bul. 573.

TYPES AND BREEDS OF SWINE.

(Six lessons; four double periods for practical work.)

LESSON 1.—*The Lard Type of Swine.*

1. Purpose and development of type.
2. Form and general appearance.
3. The score card for fat hogs.

PRACTICUM 1.—*Judging Fat Hogs.*

LESSON 2.—*The Bacon Type of Swine.*

(Same as for lard type.)

PRACTICUM 2.—*Judging Bacon Hogs.*

LESSON 3.—*Breeds of Swine.*

1. The Berkshire.
   (*a*) Characteristics and utility.
   (*b*) Origin and history.
   (*c*) The Berkshire in the United States.
   (Same outline for all important breeds of swine.)
2. The Poland China.

LESSON 4.—*Breeds of Swine*—Continued.

1. Chester White.
2. Duroc Jersey.

LESSON 5.—*Breeds of Swine*—Continued.

1. Hampshire.
2. Tamworth.
3. Large Yorkshire.
4. Any of the following breeds or others which may be of local importance: Small and middle Yorkshire, Mulefoot, Cheshire, Victoria, Essex.

LESSON 6.—*Market Classes and Grades of Swine.*

1. The swine market.
2. Grades of swine.
3. Swine products.

Special reference: Judging Swine as a Subject of Instruction in Secondary Schools, Agricultural Education Monthly, Vol. II, No. 7.

PRACTICUMS 3 AND 4.—*Judging Swine.*

IMPROVEMENT OF ANIMALS.

(Five lessons.)

References.—

Principles of Breeding and Origin of Domesticated Breeds of Animals, Separate from Twenty-seventh Report of Bureau of Animal Industry, 1910.

LESSON 1.—*Variation in Animals.*

1. Law of variation.
2. Sports and mutations.
3. Selection.
   (*a*) Natural.
   (*b*) Artificial.

LESSON 2.—*Heredity.*

1. Law compared with variation.
2. Mendel's law.
3. Cross breeding versus pure breeding.

LESSON 3.—*Prepotency.*

1. Value in breeding.
   (*a*) Prepotent individuals.
2. A study of pedigrees.
3. Registration of animals.

LESSON 4.—*Practical Problems in Breeding.*

1. Increasing variation.
2. Selection according to ideals.
3. Testing hereditary power.

LESSON 5.—*Improvement of Common Stock.*

1. Weeding out unprofitable individuals.
2. Use of pure-bred sires.
3. Cooperative breeding.
4. Cow-testing associations.

FEEDS AND FEEDING.

(Nine lessons.)

References.—

Farmers' Bulletin 22, The Feeding of Farm Animals.

The Use of Energy Values in the Computation of Rations for Farm Animals, U. S. Dept. of Agr., Bur. An. Indus. Bul. 459.

Illustrative material: Charts showing feeding standards, etc.; samples of feeds.

LESSON 1.—*Composition of Plants and Animals.*

1. Relation of animals to plants.
2. Elements and compounds.
3. Composition of plants.
4. Composition of animals.

LESSON 2.—*Nutrients.*

1. Carbohydrates.
   (*a*) Nature.
   (*b*) Sources.
2. Proteids.
   (*a*) Nature.
   (*b*) Sources.
3. Fats.
   (*a*) Nature.
   (*b*) Sources.
4. Water and mineral matter.

LESSON 3.—(*a*) *Digestion.*

1. Nature of the process.
2. Organs.
3. Importance of normal function.

(*b*) *Assimilation*, (*c*) *Excretion.*

(Same as for digestion.)

LESSON 4.—*Function of Nutrients.*

1. Carbohydrates.
2. Proteids.
3. Fats.
4. Water and minerals.

LESSON 5.—*Feeding Standards.*

1. The nutritive ratio.
2. Comparison of standards.
3. Exercises in determining ratio.

LESSON 6.—*Roughages.*

1. Place in ration.
2. Classes and composition.
3. Importance of succulence.

LESSON 7.—*Concentrates.*

1. Place in ration.
2. Classes and composition.

LESSON 8.—*Purposes in Feeding.*

1. Maintenance.
2. Growth and development.
3. Milk production.
4. Fattening for market.

LESSON 9.—*Exercises in Compounding Rations.*

For different classes of animals for purposes given in Lesson 8.

CARE AND FEEDING OF DAIRY CATTLE.

(Seven lessons.)

References.—

Special Bulletins of the Office of the Secretary of Agriculture relative to Dairying in the South.

The Dairy Herd, Its Formation and Management, Farmers' Bulletin 55.

Farmers' Bulletin 743, The Feeding of Dairy Cows.

LESSON 1.—*Management of Breeding Animals.*

1. Development of the heifer.
2. Care and management at calving.
3. Development of the dairy bull.
4. Care and management of the bull.

LESSON 2.—*Care and Feeding of the Calf.*

1. Feeding milk.
2. Necessary equipment.
3. Importance of cleanliness.
4. Ration for development.

Special reference.—Farmers' Bulletin 777, Feeding and Management of Dairy Calves and Young Dairy Stock.

LESSON 3.—*Care and Feeding in Summer.*

1. Important considerations.
   (*a*) Fresh water.
   (*b*) Shade.
   (*c*) Protection from pests.
2. Pastures.
3. Soiling.

LESSON 4.—*Care and Feeding in Winter.*

1. Important considerations.
   (*a*) Water supply.
   (*b*) Fresh air.
   (*c*) Warmth and protection from drafts.
   (*d*) Dry quarters.
   (*e*) Sanitation of the stable.
   (*f*) Exercise.
2. Roughages in the ration.
3. Concentrates in the ration.
4. Keeping the cows clean.

LESSON 5.—*Making and Feeding of Silage.*

1. Value of silage in feeding.
2. Kinds of silage.
3. Filling the silo.
4. Feeding silage to cows.

Special references.—The following Farmers' Bulletins: 292, Cost of Filling Silos; 578, Making and Feeding of Silage.

LESSON 6.—*The Dairy Barn.*

1. Location.
2. Relation of size of barn to size of herd.
3. Important requisites:
   (*a*) Ventilation.
   (*b*) Sunlight.
   (*c*) Sanitation.
   (*d*) Comfort.
   (*e*) Convenience.
4. Relation of cost to service.
5. Types and plans.

Special reference.—Individual plans furnished by Dairy Division, U. S. Dept. Agr.

LESSON 7.—*The Silo.*

1. Location.
2. Types and materials.
3. Construction.
4. Relation of capacity to size of herd.

Special reference: Farmers' Bulletin 589, Homemade Silos. Individual plans from Dairy Division, U. S. Dept. Agr.

CARE AND FEEDING OF BEEF CATTLE.

(Five lessons.)

References.—

The following Farmers' Bulletins: 183, Meat on the Farm; 580, Beef Production in the South; 635, Cottonseed Meal for Feeding Beef Cattle. Fattening Cattle in Alabama, U. S. Dept. of Agriculture Bul. 110.

LESSON 1.—*A Survey of Modern Beef Production.*

1. History of the beef-cattle industry.
2. Present status of the industry.
3. Beef making in the South.

LESSON 2.—*Care and Feeding of Young Stock.*

1. Handling of breeding stock.
2. Care and development of young stock.
3. Veal production.
4. Baby beef.

LESSON 3.—*Summer Feeding.*

1. Pastures.
2. Supplementary feeding.

LESSON 4. *Winter Feeding.*

1. The feed lot.
2. Shelter.
3. Feeds and feeding.

LESSON 5.—*Finishing and Marketing.*

1. Fattening rations.
2. Economics of beef production.
3. Marketing on the hoof.
4. Home slaughtering.

CARE AND FEEDING OF MULES AND HORSES.

(Five lessons.)

References.—

Principles of Horse Feeding, Farmers' Bul. 170.

Also special bulletin of the Office of the Secretary of Agriculture on same subject.

LESSON 1.—*Management of Breeding Animals.*

1. The brood mare.
2. The stallion and jack.

LESSON 2. —*The Care and Feeding of Colts.*

1. The sucking colt.
2. Weaning.
3. Feeding for development.
4. Protection from injury.

LESSON 3.—*Training the Colt.*

1. Halter breaking—teaching the foal to lead.
2. Fitting the harness.
3. Training to drive.
4. Breaking to ride.
5. Importance of careful training.

Special reference: Colts, Breaking and Training, Farmers' Bul. 667.

LESSON 4.—*Feeding Mules and Horses at Work.*

1. Food requirements for work.
2. Relation of feeding to capacity.
3. Methods of feeding.

LESSON 5.—*Care and Management of Mules and Horses.*

1. Watering and salting.
2. Grooming.
3. Use of blankets.
4. Care of the feet.
5. Driving and riding.

CARE AND FEEDING OF SHEEP.

(Three lessons.)

References.—

Producing Sheep on Southern Farms, Special Bulletin, Office of Secretary of the Department of Agriculture.

The following Farmers' Bulletins: 49, Sheep Feeding; 96, Raising Sheep for Mutton; 652, The Sheep Industry as Menaced by the Dog.

LESSON 1.—*Place of Sheep on the Farm.*

1. History and development of the sheep industry.
2. Opportunities in sheep husbandry.
3. Sheep on southern farms.
4. The dog menace.

LESSON 2.—*Production of Mutton.*

1. Care of sheep at lambing time.
2. Feeding for development.
3. Summer and winter care.
4. Fattening sheep.
5. Winter lambs.

LESSON 3.—*Production of Wool.*

1. Relation to mutton production.
2. Dipping sheep.
3. Shearing sheep.
4. Sheep barns.

CARE AND FEEDING OF SWINE.

(Five lessons.)

References.—

The following Farmers' Bulletins: 205, Pig Management; 438, Hog Houses; 566, Boys' Pig Clubs; 411, Feeding Hogs in the South.

Hog Raising in the South, Office of Secretary of Agriculture Circular 30.

How Southern Farmers May Get a Start in Pig Raising, Office of Secretary of Agriculture Special Circular.

LESSON 1.—*Possibilities in Pigs.*

1. Swine as economical producers of meat.
2. Consumers of farm waste.
3. Hogs following cattle.
4. How boys may get a start.

LESSON 2.—*Management of Breeding Animals.*

1. The brood sow.
2. The boar.
3. Farrowing.

LESSON 3.—*Care and Feeding of Young Stock.*

1. Before weaning.
2. After weaning.

LESSON 4.—*Fattening for Market.*

1. Costs of raising pigs.
2. Relation of cost to age.
3. Winter feeding and care.
4. Finishing for market.
5. Home curing of meat.

LESSON 5.—*Hog Houses and Yards.*

1. Importance of sanitation, dryness, ventilation, light, and warmth.
2. Relation of cost to economical production.
3. Plans of various types.

MILK AND ITS PRODUCTS.

(Ten lessons; six double periods for practice.)

References.—

Special Bulletins of the Office of the Secretary of Agriculture. Also the following Farmers' Bulletins: 349, The Dairy Industry in the South; 490, Bacteria in Milk; 541, Farm Butter Making; 602, Production of Clean Milk.

LESSON 1.—*Secretion of Milk.*

1. Nature of milk.
2. Organs of secretion.
3. Factors influencing secretion.

LESSON 2.—*Composition of Milk.*

1. Average composition.
2. Variations and causes.
3. Nature of constituents.
4. Relation to feeding.

LESSON 3.—*Fermentation Changes in Milk.*

1. Kinds.
2. Causes of fermentation.
3. Nature of the process.
4. Control of fermentation.

LESSON 4.—*Production of Clean Milk.*

1. Prevention of undesirable flavors—relation to feeding.
2. Sanitation in the stable—control of odors.
3. Sanitation in the milk room and dairy.
4. Clean milking.

LESSON 5.—*Separation and Handling of Cream.*

1. Gravity separation.
2. The centrifugal separators.
3. Care and use of separators.
4. Factors influencing per cent of fat.
5. Handling cream.

LESSON 6.—*Testing Milk and Products.*

1. History of milk testing.
2. The Babcock test—Principles.
3. Value to the industry—Practical application.
4. Tests for sediment and specific gravity.

Special reference: Complete directions with a list of equipment needed will be found in Chemical Testing of Milk and Cream, U. S. Dept. of Agr., Bur. An. Indus. Doc. A7.

PRACTICUMS 1 AND 2.—*Care and Use of Separators.*

PRACTICUMS 3 AND 4.—*Testing Whole Milk.*

PRACTICUM 5.—*Testing Skim Milk.*

PRACTICUM 6.—*Testing Cream.*

LESSON 7.—*Butter Making.*

1. Ripening of cream.
2. Churning, salting, and working.
3. Printing and marketing butter.

Special reference: Illustrated Lecture on How to Make Good Farm Butter, U. S. Dept. of Agr., Syllabus 19.

LESSON 8.—*Cheese Making.*

1. Types of cheese for the farm.
2. Making cheese on the farm.
3. Types of market cheese.

LESSON 9.—*Milk for the Market.*

1. Developing a local trade.
2. Milk shipments.
3. Essentials toward success.

LESSON 10.—*The Farm Dairy House.*

1. Plans and construction.
2. Equipment and arrangement.
3. Water supply and methods of heating.
4. Cooling facilities.
5. Sanitation.

Special reference: Farmers' Bulletin 689, Plan for a Small Dairy House. Individual plans furnished by the Dairy Division, U. S. Dept. Agr.

POULTRY.

(Fifteen lessons; six double periods for practical work.)

References—

Suggestions on Poultry Raising for the Southern Farmer, Special Bulletin, Office of Secretary of Agriculture. Also the following Farmers' Bulletins: 51, Standard Varieties of Chickens; 64, Ducks and Geese; 200, Turkeys; 287, Poultry Management; 445, Marketing Eggs; 452, Capons; 530, Important Poultry Diseases; 528, Hints to Poultry Raisers; 562, Boys' and Girls' Poultry Clubs; 574, Poultry Houses; 585, Natural and Artificial Incubation of Hens' Eggs; 594, Shipping Eggs by Parcel Post; 624, Natural and Artificial Brooding of Chickens; 682, Simple Trap Nest for Poultry; 697, Duck Raising; 767, Goose Raising.

LESSON 1.—*Fowls: Origin and Place on the Farm.*

1. Origin of the domestic fowl.
2. Status of the poultry industry.
3. Possibilities in poultry.

LESSON 2.—*Classification of Fowls.*

1. Definition of terms: Class, breed, variety, strain.
2. Classification based on country of origin.
3. Classification based on utility.
4. Classification of American standard of perfection.

Illustrative material for lessons 2, 3, 4, and 5: Charts, pictures, and lantern slides showing types and breeds of fowls.

LESSON 3.—*Utility Types.*

1. Meat type.
2. Egg type.
3. General-purpose type.

LESSON 4.—*American and English Breeds.*

1. The Plymouth Rock.
   (*a*) Characteristics of breed.
   (*b*) Varieties.
2. The Wyandotte.
3. The Rhode Island Red.
4. The Orpington.
5. The Dorking.

LESSON 5.—*Asiatic, Mediterranean, and Other Breeds.*

1. The Brahmas.
2. The Langshans.
3. The Leghorns.
4. The Minorcas.
5. Hamburgs, Anconas, Campines, Buttercups, and any other breeds of local importance.

Special reference: Lessons on Poultry for Rural Schools, United States Department of Agriculture Bulletin 464.

PRACTICUMS 1 and 2.—*Judging Fowls.*

PRACTICUMS 3 and 4.—*Study and Operation of Incubator.*

PRACTICUM 5.—*Testing and Grading Eggs.*

PRACTICUM 6.—*Preserving Eggs.*

LESSON 6.—*Natural Incubation and Brooding.*

1. Comparison of the two systems.
2. Setting the hen.
3. Care of the setting hen.
4. Management of hen and chicks.

LESSON 7.—*Artificial Incubation.*

1. Principles upon which incubator is constructed.
2. Types of incubators.
3. Incubator houses and cellars.
4. Operation of the incubator.
5. Development of the embryo.

LESSON 8.—*Artificial Brooding. Rearing Chicks.*

1. Removal from incubator.
2. Construction and management of brooder.
3. Feeding and care of chicks in brooder.
4. Brooder houses.
5. Care and feeding of young stock.

LESSON 9.—*Egg Production.*

1. The commercial egg farm.
2. Selection for egg production.
3. Feeding the layers.
4. Eggs for market *v.* eggs for hatching.
5. Securing eggs in winter.

LESSON 10.—*Poultry for Market.*

1. Production of broilers.
2. Production of roasters.
3. Killing and dressing.

LESSON 11.—*Poultry Houses and Yards.*

1. Essentials to be secured.
2. Relation of cost to economic production.
3. Building plans.
4. Equipment.
5. Systems of yarding.

LESSON 12.—*Vermin and Their Control. Diseases.*

1. Hygiene and sanitation—value of prevention.
2. Common diseases and their remedies.
3. Poultry parasites.
4. Other enemies of poultry.

LESSON 13.—*Marketing Poultry and Products.*

1. General principles involved.
2. Breeding stock.
3. Market poultry.
4. Eggs for hatching.
5. Market eggs.

LESSON 14.—*Ducks and Geese.*

1. Requirements.
2. Breeds and varieties.
3. Care and management.

LESSON 15.—*Turkeys and Guineas.*

1. Requirements.
2. Breeds and varieties.
3. Care and management.

BEES.

(Five lessons.)

References.—

The following Farmers' Bulletins: 442, Bee Diseases; 447, Bees; 503, Comb Honey; 653, Honey and Its Uses in the Home; 695, Outdoor Wintering of Bees.

Illustrative material: An observation hive of bees; an exhibit of apiary equipment.

LESSON 1.—*Natural History of the Honey Bee.*

1. Life history and structure.
2. Habits—hive activities.
3. Races of bees.
4. Honey plants.

LESSON 2.—*Modern Apiary Equipment.*

1. Location of the apiary.
2. The modern hive.
3. Other equipment.

LESSON 3.—*Manipulation of Bees.*

1. Handling of hives and combs.
2. Hiving a swarm.
3. Transferring.
4. Uniting.
5. Introduction of queen.

LESSON 4.—*General Management of Bees.*

1. Winter management and feeding.
2. Spring management.
3. Prevention of swarming.
4. Artificial swarming.
5. Treatment of disease.
6. Prevention of robbing.

LESSON 5.—*Production and Marketing of Honey.*

1. Producing comb honey.
2. Producing extracted honey.
3. Marketing honey.
4. Beeswax.

DISEASES OF ANIMALS.

(Ten lessons.)

References.—

Diseases of Cattle, Diseases of the Horse, U. S. Dept. of Agriculture. Also the following Farmers' Bulletins: 152, Scabies of Cattle; 206, Milk Fever and Its Treatment; 351, The Tuberculin Test; 350, Dehorning of Cattle; 379, Hog Cholera; 439, Anthrax; 449, Rabies; 479, Tuberculosis; 480, Disinfecting Stables; 540, The Stable Fly; 569, Texas Fever; 603, Arsenical Cattle Dips; 639, Eradication of the Cattle Tick Necessary for Profitable Dairying in the South.

Blackleg: Its Nature, Cause, and Prevention, U. S. Dept. of Agriculture, Bur. An. Indus. Circ. 31.

Foot and Mouth Disease, U. S. Dept. of Agriculture, Bur. An. Indus. Circ. 141.

How to Get Rid of Cattle Ticks, U. S. Dept. of Agriculture, Bur. An. Indus. Circ. 97.

LESSON 1.—*Unsoundness in Horses.*

1. Feet and leg troubles.
2. Harness troubles.
3. Other external ailments.

LESSON 2.—*Practicum—Examining Horses or Mules for Unsoundness.*

LESSON 3.—*Causes of Disease.*

1. Meaning of disease.
2. Relation to feeding, care, and management.
3. Value of inherited vigor and resistance.

LESSON 4.—*Parasites Causing Disease.*

1. Bacteria and disease.
2. Disease carriers.
3. Other parasites.

LESSON 5.—*Preventive Measures.*

1. Maintaining bodily vigor.
2. Sanitation.
3. Immunity by inoculation.

LESSON 6.—*Some Common Ailments and Their Treatment.*

1. Wounds and their treatment.
2. Bloating and colic.
3. Milk fever.
4. Blackleg.

LESSON 7.—*Common Ailments*—Continued.

1. Foot-and-mouth disease.
2. Rabies, tetanus, and actinomycosis.
3. Glanders.
4. Charbon and other diseases of local importance.

LESSON 8.—*Hog Cholera.*

1. Importance.
2. Cause.
3. Diagnosis.
4. Treatment.

LESSON 9.—*Texas Fever.*

1. Importance.
2. Cause.
3. Diagnosis.
4. Treatment.
5. Control of tick.

LESSON 10.—*Tuberculosis.*

1. Importance.
2. Cause.
3. Diagnosis.
4. Treatment.
5. Relation to human health.

SUGGESTIONS FOR HOME PROJECTS IN ANIMAL HUSBANDRY.

Care of calves on personal account.
Care and feeding of one or more cows for one year.
Keeping a dairy herd record for one year.
Developing a local milk or butter trade.
Production of baby beef.
Fattening cattle for the market.
Developing swine for breeding.
Feeding swine for pork production.
Care of sheep on personal account.
Care of sheep for share of increase.
Care and training of colts.
Care and management of team.
Care and management of poultry.
Handling bees on personal account.

ACCEPTABLE SUBSTITUTES FOR PROJECTS.

Work on general stock farm.
Work on dairy farm.
Work on poultry farm.
Work in apiary.

EQUIPMENT FOR ANIMAL HUSBANDRY.

A stereopticon with sets of lantern slides showing types and breeds of farm animals and poultry.
Score cards for use in judging.
An exhibit of commercial feeds.
A Babcock testing outfit.

A separator, churning outfit, and such other dairy equipment as may be obtained.

An incubator, a brooder, and such other poultry equipment as may be obtained.

A poultry plant at the school will be found invaluable, not only in teaching poultry husbandry but also in working out and applying general principles relating to the breeding, feeding, and general care of farm animals.

A stand of bees, preferably in an observation hive. Such apiary equipment as may be obtained.

TEXTS AND REFERENCES FOR ANIMAL HUSBANDRY.

The following list of books is recommended by the Commission on Accredited Schools of the Southern States and is published here simply for the convenience of teachers.

1. American Standard of Perfection. Mansfield, Ohio: American Poultry Association, 1915, new ed.
2. Comstock, A. B. How to Keep Bees. Garden City, N. Y.: Doubleday, Page and Co., 1905.
3. Craig, J. A. Judging Live Stock. Des Moines, Iowa: Kenyon Printing and Manufacturing Co., 1914, rev. ed.
4. Craig, J. A., and Marshall, F. R. Sheep Farming. New York: The Macmillan Co., 1913.
5. Craig, R. A. Common Diseases of Farm Animals. Philadelphia: J. B. Lippincott Co., 1915.
6. Curtis, R. S. Fundamentals of Live Stock Judging and Selection. Philadelphia and New York: Lea and Febiger, 1915.
7. Davenport, Eugene. Domesticated Animals and Plants. Boston: Ginn and Co., 1912.
8. Day, G. E. Productive Swine Husbandry. Philadelphia: J. B. Lippincott Co., 1915 2d ed. rev.
9. Dietrich, William. Swine. Chicago: Sanders Publishing Co., 1910.
10. Eckles, C. H. Dairy Cattle and Milk Production. New York: The Macmillan Co., 1911.
11. Gay, C. W. The Principles and Practices of Judging Live Stock. New York: The Macmillan Co., 1914.
12. Gay, C. W. The Breeds of Live Stock. New York: The Macmillan Co., 1916.
13. Gay, C. W. Productive Horse Husbandry. Philadelphia: J. B. Lippincott Co., 1913.
14. Harper, M. W. Manual of Farm Animals. New York: The Macmillan Co., 1911.
15. Harper, M. W. Animal Husbandry for Schools. New York: The Macmillan Co., 1913.
16. Harper, M. W. The Training and Breaking of Horses. New York: The Macmillan Co., 1912.
17. Harper, M. W. Management and Breeding of Horses. New York: Orange Judd Co., 1913.

18. Henry, W. A., and Morrison, F. B. Feeds and Feeding. Madison, Wis.: The Henry-Morrison Co., 1915.
19. Hunt, T. F., and Burkett, C. W. Farm Animals. New York: Orange Judd Co., 1914.
20. Johnstone, J. H. S. The Horse Book. Chicago: Sanders Publishing Co., 1914.
21. Kleinheinz, Franz. Sheep Management. Madison, Wis.: Author, 1916, 3d ed. rev. and enl.
22. Lewis, H. R. Poultry Keeping. Philadelphia: J. B. Lippincott Co., 1915.
23. Lippincott, W. A. Poultry Production. Philadelphia: Lea and Febiger, 1914.
24. Marshall, F. R. Breeding Farm Animals. Chicago: Sanders Publishing Co., 1911.
25. Mayo, N. S. The Diseases of Animals. New York: The Macmillan Co., 1913, 8th ed.
26. Michels, John. Dairy Farming. Farmingdale, N. Y.: Author, 1912.
27. Mumford, H. W. Beef Production. Urbana, Ill.: Author, 1907.
28. Phillips, E. F. Beekeeping. New York: The Macmillan Co., 1915.
29. Plumb, C. S. Beginnings in Animal Husbandry. St. Paul, Minn.: Webb Publishing Co., 1913.
30. Plumb, C. S. Types and Breeds of Farm Animals. Boston: Ginn and Co., 1906.
31. Reynolds, M. H. Veterinary Studies for Agricultural Students. New York: The Macmillan Co., 1911.
32. Robinson, J. H. Domestic Birds. Boston: Ginn and Co., 1914.
33. Rose, Laura. Farm Dairying. Chicago: A. C. McClurg Co., 1911.
34. Van Norman, H. E. First Lessons in Dairying. New York: Orange Judd Co., 1903.
35. Wilcox, E. V., and Smith, C. B. Farmer's Cyclopedia of Live Stock. New York: Orange Judd Co., 1908.
36. Wing, H. H. Milk and Its Products. New York: The Macmillan Co., 1913.
37. Wing, J. E. Sheep Farming in America. Chicago: Sanders Publishing Co., 1912.
38. Woll, F. W. Productive Feeding of Animals. Philadelphia: J. B. Lippincott Co., 1915.

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